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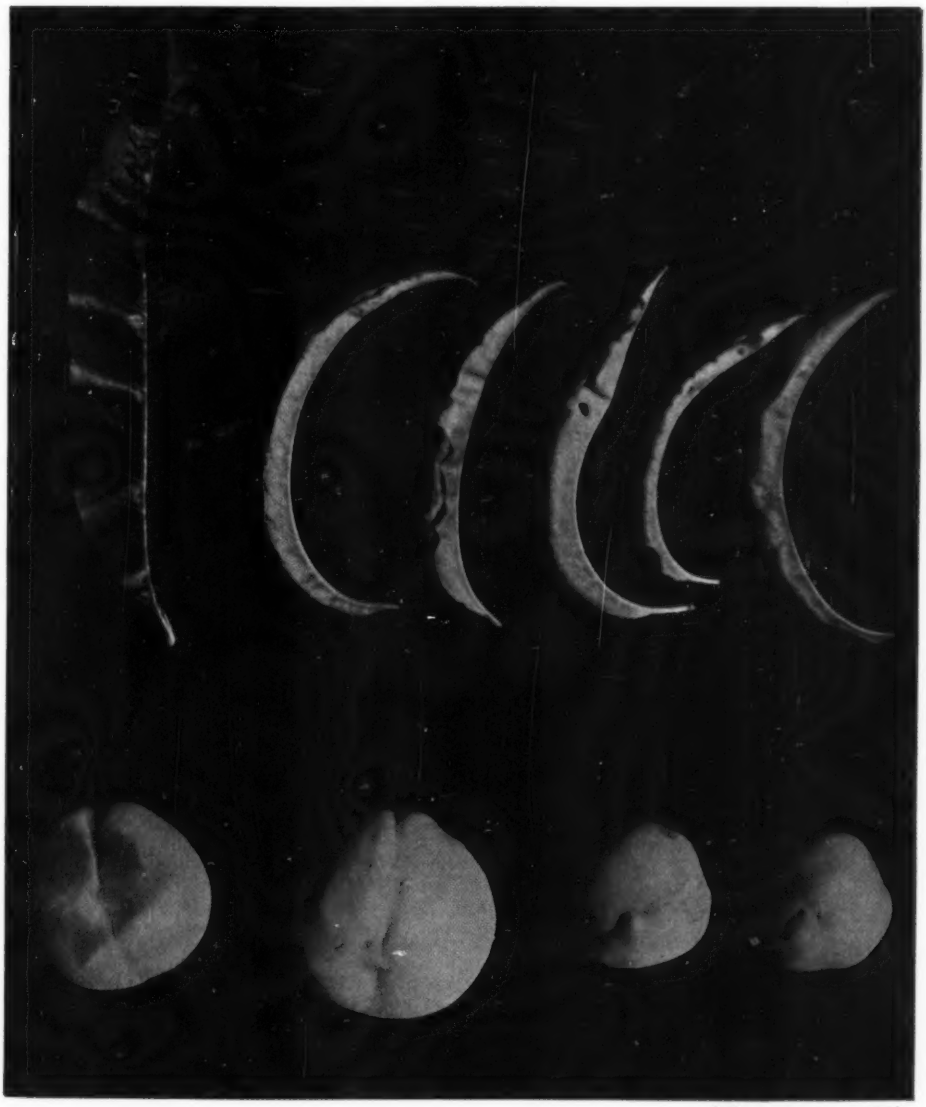

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Editorial Office: 1102 16th Street, N. W., Washington 6, D. C.

VOLUME XXXVIII NO. 10

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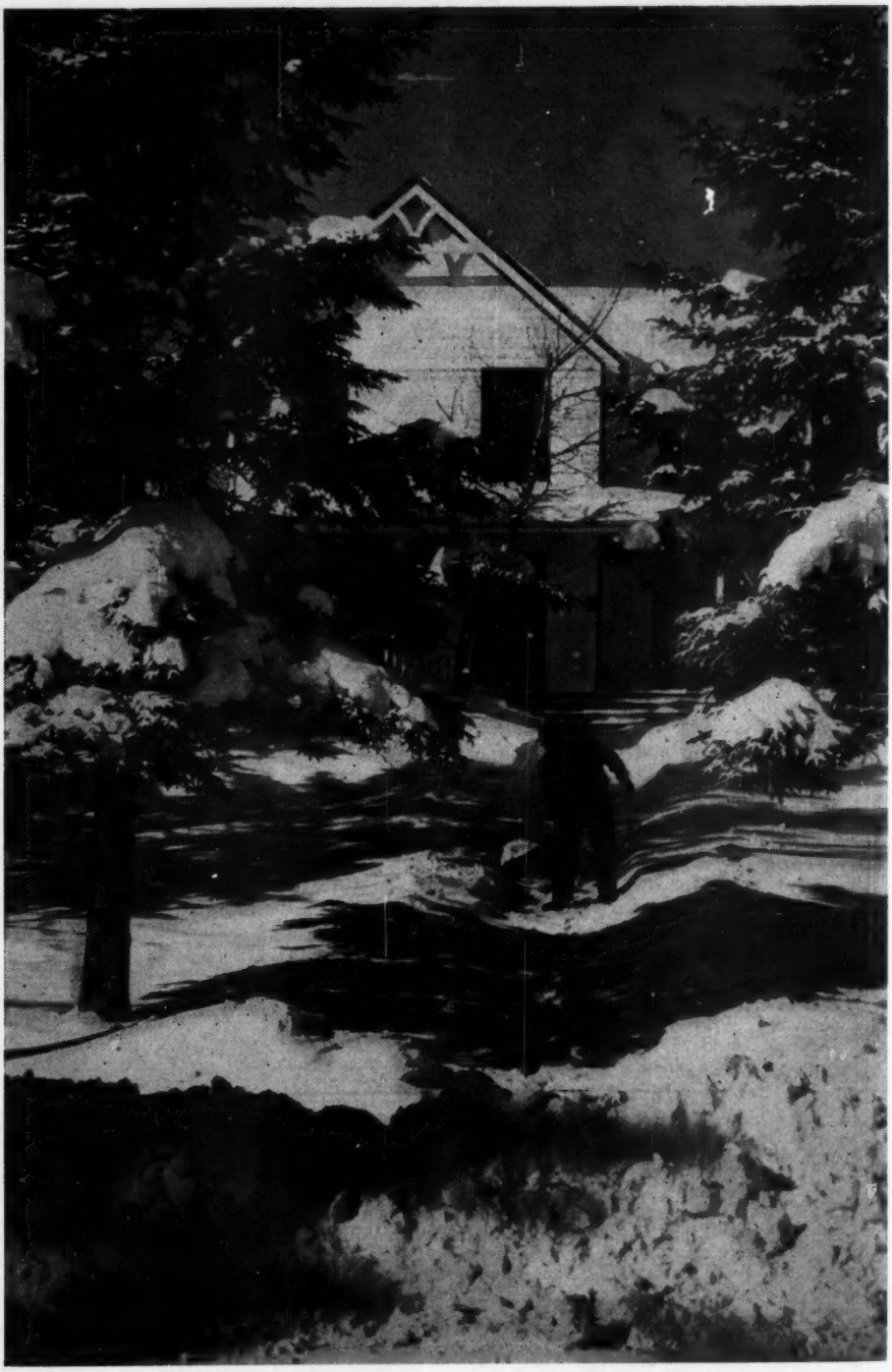

Clearance for Hospitality

Better Crops with PLANT FOOD

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VOL. XXXVIII WASHINGTON, D. C., DECEMBER 1954 No. 10

Looking Back . . .

Was Youth So Long Ago?

Jeff McDermid

IN those carefree times of 40 years ago, he said that he walked that same old street every day but Sunday, twice uptown and twice returning. He said he was then more confident and daring, that he thought his job was the greatest one in the world for him, and his new wife was the most wonderful of any in the universe. So that made every day like Christmas. Subsequently he discovered in a gradual way that his job was not quite the glorious opportunity he had imagined, and that making every day into Christmas takes a lot of doing as well as dreaming and preparing, with the well-banked embers of hope and pride to keep that spirit burning.

But still and all, he snuggled under his coat a heart made warm and joyous by that part of his life which never gave him bitterness or disappointment —the faith and courage and constancy of the same steadfast companion. Morning, noontime, and eventide—always a spot to call "home."

His street was a regular small-town thoroughfare, not paved at all with clouds and billows of foam—as one would suppose from the lightness and bounce in his eager feet. It passed through five or six solid blocks of those double and triple railroad flat style of "income-producing residences." They were mostly well built by artisans of repute and pride of craft, who used the best of materials in times when quality and pains counted most.

Signs of household activity and home tasks and pleasures greeted him in his daily walks. In the spring, it was house-cleaning duties he observed, women with pails, mops, brooms, dusters, and beaters, laying it on the line

for sanitation and neatness. Devoted gardeners glanced up from their spading to speak about the weather or the choice of seeds. Others labored in protest at the hanging of the screens, the moving of the parlor stoves, and disposal of the rubbish.

IN summertime, folks sat out there on the wide front porches or in wooden kitchen chairs at the outer edges of the sidewalks, ready to talk "thermometer." The denizens of that zone had no waiting motor cars to whisk them far from the sweat and smoke of the town, no radios and television to beguile their hours of ease. Cheery chats with close neighbors, conning the six-page daily ("too many patent medicine ads") and amusing the kids with kites or hoops—provided their solace in summer. These and the scissors grinder with his swinging bell or the organ grinder with his penny-clutching monkey were street diversions of those old contented commoners.

In the tangy autumn, old and young busied themselves with leaf raking and burning, the pungent smoke wreaths rising from these last vestiges of the vernal equinox dropped from the rows of elms, oaks, and lindens. One walked past open doors where folks sought to catch the last balm of the summery wind as it tweaked away the litter from the yards and walks. Later, after the football season and the kids quit punting up and down the street, there came a change. Ponderous coal wagons moved where the ice trucks lately rumbled. The slur of fuel going down the chutes matched the whine of the gas power saw rig, cutting cordwood for the kitchen ranges along this civic way.

But the best of all meanderings came when he paced by these homes preparing for the Christian festivals of November and December. Then he saw mothers and dads lugging in bundles and baskets, children chattering gleefully in anticipation of the coziness and plenty that waited for them around the hearth and table. And finally, the dragging in of pumpkins, evergreens, and holly—with evening panes aglow with household welcome, as kinfolks came and one more year was clinging in its last vain shred to the gaudy drugstore calendar.

Our observant young man noted all such sundry signs of community welfare and juvenile merriment, as well as the evidence of misfortune and sorrow that somehow creep in to try brave hearts sorely and teach bereaved and sick ones that misery is a test of character and a call for prayer and faith. In his happiness and youth, he did not shun the abode of stricken ones, but did his meager part to comfort, aid, and console. He thought that it was right to be kind when life had been tender to him.

IN two nostalgic and delightful books of reminiscences about Paris, Elliott Paul confines his whole world of keen observation and philosophy to picture the characters living within a couple of blocks in a narrow street just off the Avenue St. Michel near the south bank of the Seine. It was much the same way with our humble young man. His business enabled him to spend some of his spare hours in getting to know the "habitants" of that small, second-rate group of households, whose lives were mirrors of the cosmos itself—just as the moon and the stars are reflected in a farm pond or a big puddle in some obscure and remote location which is far away from everything except God. He believed that all human emotions, strivings, and rewards had a common basis and a continued brotherhood—not just something to trot out with tinsel talk at Christmastide, but a constant means of finding true character, sometimes heroism, but more often strong minds, warm hearts, and common sense.

In a small, neat, frame house of the upright and ell fashion of those years, with a lilac bush at the end of the open front porch that had a broken down sofa for a divan in all weathers, lived a widow woman with a 'teen-age

boy who "didn't have all his buttons." This stout-hearted person bore herself with a rather majestic air—if you could see past the outward blemishes of excess fat and unkempt hair. Her majesty of bearing lay in the conquest of her fate. In quick succession, she had lost her husband, one fine son, and a talented daughter.

She and her husband had begun life together quite well and hopefully. The

two older children gave them no trouble, and studied hard and learned fast. They finished high school with honors and then went on to make excellent records in the college world. The girl was a language teacher, and the boy became a temporary celebrity in athletics. Then the triple blow fell, stranding the poor mother with a very nominal income to take care of herself and the bumbling son. Every day these two walked up and down the street, often with no very real objective. Sometimes they encountered the open grins of strangers or the equally depressing pity shown by neighbors and friends.

This cross was hers to bear until the end. She refused to part with her useless boy to put him in a mental hospital. She saved and struggled to establish a sort of endowment for the boy, who spent his confused but harmless lifetime with private caretakers after his mother died.

In the next block lived a ladies' tailor and his family of three. He hung out his sign at home to help eke out an income for his wife and a spastic daughter who spent all her waking hours in a cramped wheel chair. So cheerful and agreeable she was, this twisted, frail young thing with inanimate form, that many of the children loved to visit the home and help her pass the time pleasantly. The parents welcomed these young intruders always. In summer they took her carefully down the steep steps to the brick sidewalk, and put her in the roving chair—romping beside her or pushing the rubber-tired vehicle on little excursions to the outdoors.

Sometimes with her mother along, they all visited the Main Street stores, where the clerks on weary legs walked after the little group and tried to make believe this was a great event for sales and custom. She learned her daily lessons at home and practiced them with her mother and the visiting children. Many of the boys and girls spent part of each Saturday and some of their evenings being regular "classmates" of their less privileged companion.

BY the time she was 18, a talent for writing expressively and clearly had come to her. The local newspaper, after some prompting, appointed her its school reporter. Her friends were her daily informers about the school, its courses, and its officers, and the teachers and supervisors soon caught on and helped supply the facts. Before long, the local sheet had set a pattern for the countryside in the keenness and vigor of its academic news and views. Before she was 25, the largest daily journal in the state offered her sufficient income to induce her folks to move there—tailor shop and all—which gave a happy ending to this saga of the town.

One of the kids who used to play with the old fifth ward gang was a bright, sturdy chap whom our young man always admired. He admired this chum of his for numerous reasons. The

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Alfalfa in Mixtures for Pasture, Silage, and Hay

By R. E. Blaser

Department of Agronomy, Virginia Polytechnic Institute, Blacksburg, Virginia

THE production of grass-legume mixtures, in the absence of nitrogen fertilization, primarily depends on the growth of the legume and on the nitrogen it fixes for the grasses grown with it. Where legumes grow well and are perennial, it is possible to get high yields of good quality herbage from grass-legume mixtures. In environments where a legume like alfalfa is exceptionally well adapted, the legume alone is often as productive as a mixture of grasses and legumes. When all growth factors are favorable, a legume will fix more than 200 pounds of nitrogen per acre per year, which is about equivalent to the protein in 4 tons of a dairy feed 16% in protein content.

There are serious problems with legumes. They are often short-lived or unproductive because of adverse weather, soil conditions, grazing and/or cutting, diseases and insects. They are much more vulnerable to injury or loss of stand than grasses. As yet, there is no sure perennial legume, and so nitrogen fertilizer or renovation practices are necessary to maintain the production of pastures and meadows. Poor legume growth and low nitrogen

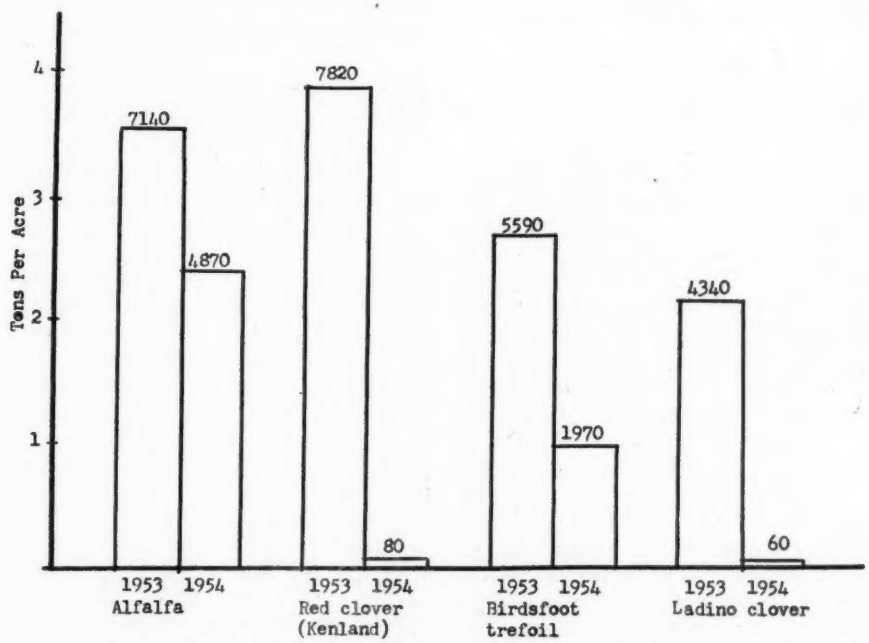

Fig. 1. The yield of four legumes when grown alone during a two-year period. The legumes were sown in pure stands. The experiment was established in spring 1952.

fixation also reduce the production during certain seasons of the year.

Are Legumes Perennials?

In our experiments in Virginia we have work with white clover, ladino clover, birdsfoot trefoil, big trefoil, red clover, alsike clover, and alfalfa. These seven legume species could maintain their production for three years or more, if biological, climatic, and soil factors that affect growth could be kept favorable. Under the adverse weather conditions encountered the last three years, alfalfa has been more productive and longer-lived than the other legumes.

In the spring of 1952, we established an experiment at Blacksburg to study the adaptation of four legumes [alfalfa, Kenland red clover, birdsfoot trefoil (Italian source), and ladino clover]. These four legumes were sown alone and in various mixtures. Grasses were intentionally omitted so as to get a better idea of the adaptation of the legume.

The soil was limed to obtain a pH of about 6.7 which is high enough for all of the legumes. Phosphorus and potash were applied in amounts to support good growth, at the rate of an 0-90-90 per acre for establishment and an 0-70-70 for maintenance each year. To measure the effect of boron fertilization, one half of each legume plot was treated with borax while the other half was not.

The yields in pounds of oven-dry hay are shown in two graphs, Figures 1 and 4. In 1953, the year after sowing, the hay yields for pure stands of legumes were: alfalfa—7,140 pounds; Kenland red clover—7,820 pounds; birdsfoot trefoil—5,590 pounds; and ladino clover —4,340 pounds per acre. The rainfall during 1953 was below normal and poorly distributed, but the yields may be classified as reasonably good. The hay yields for 1954 for these same four legumes are also shown in Figure 1. Alfalfa produced 4,870 pounds of oven-dry hay as compared with 60 to 80 pounds per acre for Kenland red clover and ladino clover. Birdsfoot trefoil produced about one half as much alfalfa, 1,970 pounds per acre in 1954.

The low yields of Kenland red clover and ladino clover in 1954 are attributed to the loss of stands as shown in Figures 2 and 3. These photographs from the experimental area show the first growth obtained in 1954. Prolonged dry weather conditions during the fall of 1953 (Table I), and abrupt reduction in temperatures during the winter months in the absence of snow cover, apparently caused the ladino clover plants to die. It is possible that the injury to ladino clover was aggravated because it was grown in the absence of grasses. However, ladino clover stands were lost in pastures and meadows in all parts of Virginia regardless of the fertilization and management.

Only a few plants of Kenland red clover survived. Although Kenland red clover is better adapted than other red clover varieties, it does not behave as

TABLE I.—RAINFALL DURING THE GROWING SEASON AT BLACKSBURG, VIRGINIA

Year	Inches Per Month								
	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.
1953	4.25	2.73	4.26	5.75	1.88	2.18	1.57	0.50	0.56
1954	3.52	2.22	3.99	1.48	3.98	3.02	1.52	.....	.....
Average (56 yrs.)	3.49	3.05	3.71	4.27	4.94	3.93	3.02	2.86	2.27
Average per year	40.9								

a perennial in Virginia. The spring growth and stands of alfalfa during the second year were excellent, Figure 3. In the second productive year, birdsfoot trefoil (an Italian source) produced 1,970 pounds as compared with 4,870 for alfalfa. The stand of birdsfoot trefoil was only fair when compared with alfalfa. It has generally been possible to get good stands and growth of birdsfoot trefoil in Virginia during the year of establishment. However, birdsfoot trefoil stands thin out with age because of serious diseases and unknown factors.

Ladino clover and alfalfa are classified as perennial legumes. The excellent survival of alfalfa under dry weather conditions is attributed to its deep root system which improves drought tolerance. The alfalfa shoot buds that grow into new stems are protected by a thin cover of soil. This soil protection is very important as dry weather does not dry out and kill alfalfa buds easily. In the case of ladino clover, which like strawberry plants has runners on the soil surface with root and topshoot buds, dry weather dries out and kills the buds rather easily.

Because both root and shoot buds on ladino clover runners are on the soil surface, they are also exposed to extreme temperature alterations, hence, cold temperature injuries are often serious or cause death. Alfalfa shoot buds under the soil surface are protected from these extreme daily temperature changes, hence, alfalfa injuries from low temperatures or great variations in temperature are not usually considered serious.

Since alfalfa is tolerant of droughts and adverse temperatures on well-drained soils, it should be used more prominently in mixtures for silage, hay, and grazing purposes. In the same experiment reported above, we used alfalfa with other leguminous plants in mixtures as shown in Figure 4. A mixture of red clover and alfalfa produced 6,460 pounds of dry matter the first year as compared with 4,220 in the second productive year. When ladino clover was used with alfalfa, the first year's yield amounted to 5,650 pounds as compared to 4,140 in the second year.

Fig. 2. Experiment with four legumes (birdsfoot trefoil, alfalfa, Kenland red clover, and ladino clover) grown alone and in mixtures at Blacksburg, Virginia. The experiment was established in spring 1952 and the pictures of the first growth in spring 1954 show excellent survival and stands of alfalfa. (See Fig. 3 for details.)

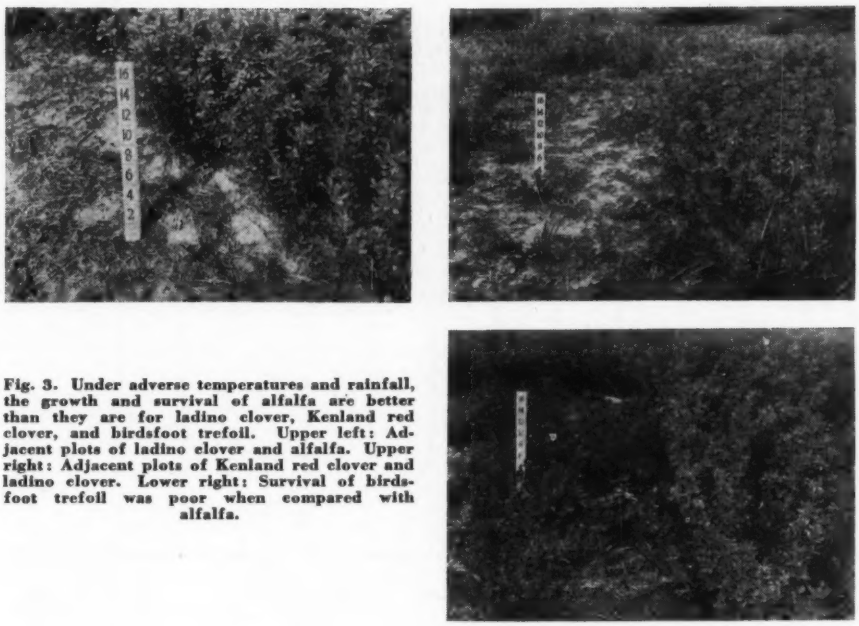

Fig. 3. Under adverse temperatures and rainfall, the growth and survival of alfalfa are better than they are for ladino clover, Kenland red clover, and birdsfoot trefoil. Upper left: Adjacent plots of ladino clover and alfalfa. Upper right: Adjacent plots of Kenland red clover and ladino clover. Lower right: Survival of birdsfoot trefoil was poor when compared with alfalfa.

However, when red clover and ladino clover were used together in the absence of alfalfa, the first year's yield amounted to 5,490 pounds per acre as compared to no production in 1954. These data clearly show that alfalfa increased the yields and lengthened the production period of mixtures. In mixtures where alfalfa was present, the high yields during the second productive year were associated with the survival of alfalfa, as pointed out earlier.

By observing Figure 4, it will be noticed that we used a mixture of ladino clover and birdsfoot trefoil. The yield during the first productive year amounted to 5,700 pounds of dry hay as compared with only 710 pounds during the second year. In this particular mixture the aggressive ladino clover growth during the first year crowded out much of the birdsfoot trefoil, hence, the first year's yield was made up primarily of ladino clover. Because of the adverse moisture and temperature conditions, all of the ladino clover died out during the end of the first productive year and the beginning of the second year, hence, the yield during the second productive year is attributed to the survival of birdsfoot trefoil.

We have many other experiments that show advantages of using alfalfa with grass-legume mixtures. For example, in another experiment near Blacksburg, Virginia, we are studying the yield and length of productive life of different grass and legume mixtures as shown in Table II. During a two-year period alfalfa alone produced 7,720 pounds of dry matter per year. Alfalfa with orchardgrass produced 8,230 pounds of dry matter as compared with 3,670 pounds per acre for an orchardgrass-ladino clover mixture. When alfalfa was added to a ladino clover-orchardgrass mixture, the yield was increased to 7,660 pounds of hay per acre. The yield of ladino clover with Kentucky 31 fescue was about the same as for an orchardgrass-ladino clover mixture. When a well-adapted strain of white clover was used with bluegrass and birdsfoot trefoil, the yields for the two-year period amounted to 4,090 pounds of dry matter.

Data for this mixture experiment at

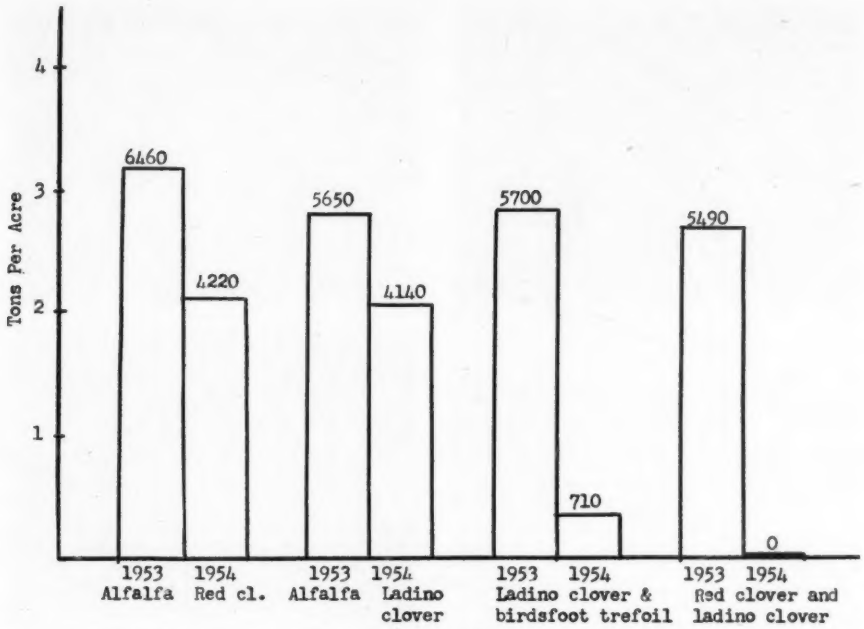

Fig. 4. The yield of several grass-legume mixtures during a two-year period. Data from same experiment given in Fig. 1.

Blacksburg are available for 1953 and 1954, and the yield trends continue to favor alfalfa. It should be stressed here that the exceptionally high yields of mixtures with alfalfa in them are attributed to the fact that prolonged periods without rain have retarded the ladino clover growth and stands much more than those of alfalfa. It should also be emphasized that the initial stands of ladino clover were not classed as satisfactory. In other experiments where soil moisture is reasonably favorable as a result of natural rainfall, ladino clover mixtures will yield about two thirds to three fourths as much as alfalfa mixtures. Under irrigated conditions where moisture is not a limiting factor, preliminary experiments show that ladino clover-grass mixtures have outyielded alfalfa mixtures during

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TABLE II.—MIXTURES INFLUENCE THE YIELDS OF HERBAGE, BLACKSBURG, VIRGINIA

Mixture and sowing rate per acre	Dry matter—Lbs. per acre	
	Average for 1951 and 1952	Yield of legume fraction in 1952
Alfalfa—20 lbs.	7,720	8,525
Alfalfa—20, orchardgrass—3 lbs.	8,230	6,479
Alfalfa—10, ladino clover—1, orchardgrass—3 lbs.	7,660	6,058
Ladino clover—2, orchardgrass—8 lbs.	3,670	136
Ladino clover—2, Ky. 31 fescue—8 lbs.	3,370	294
Bluegrass—10, Va. white clover—1, birdsfoot trefoil—10 lbs.	4,090	1,308

New Varieties Contribute to Wheat Production in North Carolina

By G. K. Middleton

Department of Agronomy, North Carolina Agricultural Experiment Station, Raleigh, North Carolina

DURING the 10-year period 1945-54, Atlas 50 and Atlas 66 have an average production record of 35.0 bushels per acre in 19 tests conducted on the Piedmont and McCullers Branch Experiment Stations in North Carolina. Several other varieties have done as well, and in some instances better, during the past four years. These include Coker 47-27, Anderson and Taylor, and in the Piedmont, Chancellor and Knox.

For purposes of illustration the full 10-year period is used, and the record of the two Atlas strains compared with that of Leap and Purplestraw, two old standards. In the same 19 tests referred to above, the standards yielded 25.8 bushels on the average as com-

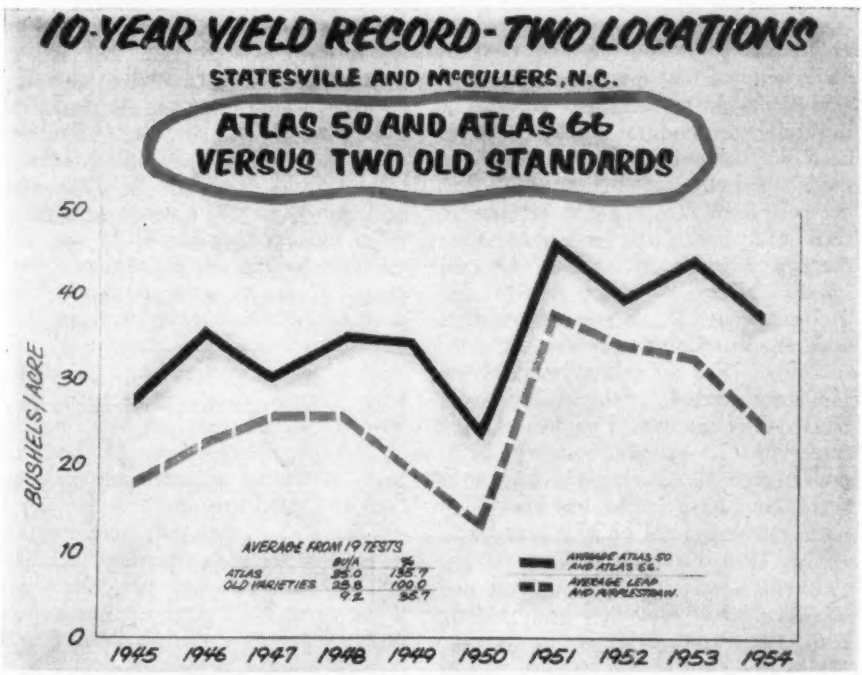

Fig. 1. Comparison in North Carolina of Atlas 50 and Atlas 66 with two old standards, Leap and Purplestraw, for a 10-year period. In 19 tests there was an average difference of 9.2 Bu/A, or 35.7% in favor of the new varieties.

Fig. 2. An average yield of 33 Bu/A of Atlas 50 was produced on 110 acres by J E. Wilder, Auburn, N. C. This was on Coastal Plain soils. In producing this crop, 400 pounds of a 2-12-12 fertilizer were used at planting time, followed by 75 pounds of N in February. The crop was seeded at the optimum time, or in late October.

pared with 35.0 for the two Atlas strains. This was an average difference of 9.2 bushels per acre, or 35.7 per cent. A glance at the accompanying chart makes the distinction more convincing, for it is noted that the new wheats had a higher yield record each year.

While the two strains of Atlas have been on test for 10 years, they have made their chief contribution during the past four. Only a few acres were certified in 1949 and a large volume for the first time in 1950. From the mill standpoint, the 1951 crop was the beginning point. It is interesting to note what the situation was before and since this time. For the 5-year period 1946-1950, the average yield of wheat in North Carolina was 15.5 bushels per acre, with 17.5 one year being the highest on record. During the past four years the average yield has been 21.5, with a record yield of 23.0 bushels in 1951. This increase from an average yield of 15.5 to 21.5 is not all attributed to Atlas 50 and Atlas 66 wheat. Along with the rapid increase in acreage seeded to these two stiff-strawed wheats there was an increase in the use of fertilizer and a general improvement in cultural practices—growers trying for maximum yields. Then growers have been favored with good seasons.

While it is impossible to say how much of the average six bushel per acre gain should be attributed to the new varieties, an estimate can be made. A difference of 35.7 per cent, calculated on a basis of a 15.5 bushel average yield, would be 5.5 bushels for each acre in Atlas. The total acreage in Atlas has been estimated as one half the State's crop during the past four years. If this is a fair estimate, Atlas contributed an average gain of 2.75 bushels per acre for the entire crop. Without these new wheats, then, the State average would have been 18.25 bushels for the past four years instead of 21.5, the increase from 18.25 to 21.5 being attributed to better cultural practices and good seasons.

This 2.75 bushels per acre increase on 400,000 acres has amounted to 1,100,000 bushels extra wheat per year, which if valued at $2.00 per bushel amounted to $2,200,000.00. With a 316,000 total acreage in 1954, this figure was smaller unless the proportion of the total seeded

(*Turn to page* 50)

Potassium Affects Growth of Stocks

By Garth A. Cahoon[1] and Duane O. Crummett[2]

STOCKS *(Matthiola incana)*, which are native to southern Europe, are grown and admired for their beauty and fragrance as garden and cut flowers throughout most of the world. They are produced commercially under a variety of cultural and environmental conditions arising out of diverse climatic situations. In most of the United States, stocks are grown as a greenhouse crop in raised or ground beds. Here, controlled minimum temperatures are necessary during the colder months to prevent damage from freezing. This simultaneously provides the required temperature (below 60° for approximately 21 days) for flower initiation during the early growth stages. In California, stocks are grown as a field crop, mostly during the fall and winter months with the principal production coming from December to February. A few coastal areas such as Santa Maria, Lompoc, and Palos Verdes are cool enough to produce good quality stocks most of the year.

Among the numerous floricultural field crops produced in southern California, stocks constitute the second largest one in terms of acreage. Between 700 and 800 acres were grown in 1951-52 and more than 900 acres in 1952-53. A sizable acreage is also devoted to seed production. The best available information places acreage in chrysanthemum production greater than stocks with aster acreage slightly less. The yearly gross value of the stock cut-flower crop is between two and three million dollars.

Until recent years a grower in western United States could be fairly certain that when planting his crops the element potassium (K) would not be a limiting factor in plant growth. There were and, generally speaking, still are large accumulations of potassium in most of these soils, although only a small part of it can be considered available for immediate absorption by the plant. Fixed potassium apparently exists in equilibrium with the exchangable and soluble phases of the soil. Thus potassium considered "unavailable" at one time may gradually reach an "available state." Similarly the reverse condition can take place, i.e., potassium applied as fertilizer may be fixed in the soil and become unavailable to the plants. The rate of potassium released from this non-exchangeable fraction as well as differential potassium uptake by plants has been the object of numerous investigations (1, 2, 4, 6, 7, 9).

With continual cropping, some of these soils apparently have been depleted of native soil potassium to a point where deficiencies have arisen, resulting in a reduction of quality and yield. It might also be supposed in some cases that irrigation waters and fertilizer applications have altered the cation ratios on the exchange complex, thus contributing to the increase

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of potassium deficiency in plantings. One of the first reports of severe potash deficiency on stocks in California was made by Kimball in 1950 (5), although various milder instances had been observed earlier. More recently, typical deficiency symptoms have been noticed in southern California with increased frequency by the authors and the growers.

Survey Made

In 1953 a survey was completed covering representative stock-growing areas throughout southern California. One of the principal objectives was to determine the general potassium status of commercial stock plantings. Another was to investigate potassium absorption as it was affected by the cation contents of the soils. Consideration also was given to the influence of various cultural practices and environmental conditions. Considerable data had accumulated from controlled nutritional studies pointing toward relatively large quantities of potassium being normally absorbed by stocks, amounting to a frequent content of 4-6% in the dry leaf tissues. Comparative information from field conditions, it was felt, would provide additional evidence to supplement and support these data.

The stock variety selected for this survey was the popular white flowering—AVALANCHE. Previous cultural studies had shown only small, but significant, differences between the potassium content of 16 commercial varieties tested.

The sampling method used in this survey resulted from observations and previous findings obtained in greenhouse experiments. Mature leaves were collected from the top and bottom region of 25 representative plants selected at random from each field planting, together with a composite soil sample from the same area. The leaves were placed in polyethylene bags immediately after picking to keep them fresh until they were washed in distilled water, dried in a forced-draft oven at 70° C., and ground in a Wiley mill to pass a 40-mesh screen.

The soil samples were air-dried and uniformly mixed before aliquots were taken for analysis. Routine methods were used to determine total potassium (K), calcium (Ca), magnesium (Mg), sodium (Na), and nitrogen (N), in the plant tissues and the neutral ammonium acetate extractable fraction of the same elements in the soil samples.

From a given planting, the concentrations of several of these cations found in the plant tissue were compared with cations from their respective soils by statistical analysis. By such methods it was thought that some of the factors influencing the potassium uptake by the plant could be more clearly revealed. Thus, more adequate information on the causes of potash deficiency in stocks might be obtained.

As can be seen from Fig. 1, a good stand of stocks—even in the earlier growth stages—provides a dense ground cover. There are usually 500,000 to 750,000 seeds sown per acre, representing two to three pounds of seed. A grower considers 12-16 plants per linear foot of row to be a desirable stand. If there are only 12 plants per foot, in rows planted 30 inches apart, there would be approximately 209,000 plants per acre. Average plantings producing about 20 grams dry weight per plant would amount to 4,180,000 grams or 4.6 tons of plant material per acre. This competition for nutrients as well as for above ground space created by such dense plantings is considered advantageous by the growers from the standpoint of eliminating the weaker single-flowered plants that are nonmarketable. As a result there is an increase in the percentage of desirable double-flowered plants that mature. When conditions are present in soils that adversely affect potassium absorption, this will tend to be more rapidly reflected in plants subjected to such competitive conditions.

Fig. 1. A field planting of stocks as grown in southern California, illustrating the relative spacings and density.

An indication of the relative amounts of available macronutrients required to support an acre of stocks is presented in Fig. 2. These quantities are all reported as the elemental form. For example, 323 pounds of potassium, when calculated as K_2O, amounts to 389 pounds. Other elements represented in the Table are 200 pounds of calcium (Ca), 369 pounds of nitrogen (N), 20 pounds of magnesium (Mg), and 25 pounds of phosphorus (P) per acre. It will be noted that the values for potassium and nitrogen are comparatively

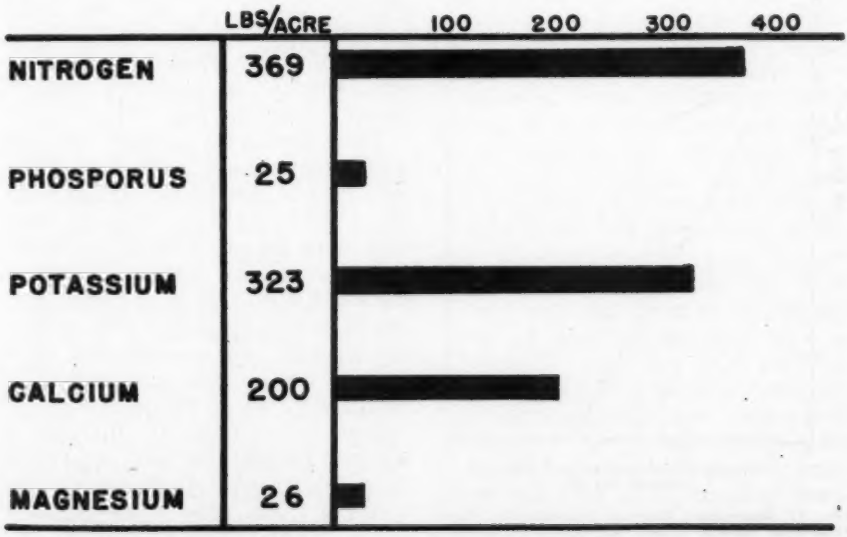

Fig. 2. Estimated crop requirement of a stock planting for several macronutrient elements.

high.

The points of considerable interest in this field survey are given in the results of the correlations between the plant and soil analyses (see Table). The correlation coefficient for the potassium content found in the top leaves compared to the soil potassium was +.050, and +.094 for the bottom leaves, both of which are not significant (a coefficient of 1.00 represents absolute correlation). The amount of potassium taken from the soil by standard extraction techniques, which are assumed to be a measure of the soluble and exchangeable potassium, thus did not give an indicaton of the ability of stocks to accumulate potassium. It is, therefore, possible for the extractable soil potassium to appear high but the plant potassium to be low, or the soil potassium to be low and the plant potassium to be high. In contrast, it was found that the Ca/K ratio of the soil greatly influenced the plant potassium content (—.708). The correlation of Cation/K ratio with potassium in the lower leaf was essentially the same (—.706). Both

TABLE — CORRELATION COEFFICIENTS REPRESENTING COMPARISONS BETWEEN PLANT TOTAL ANALYSIS AND AMMONIUM ACETATE EXTRACTABLE SOIL ANALYSIS.

Comparison	r
Plant potassium:	
Bottom leaves×Soil potassium.	.094
Bottom leaves×Soil calcium..	—.595**
Bottom leaves×Soil Ca/K....	—.708**
Bottom leaves×Soil Cation/K.	—.706**
Top leaves×Soil potassium....	.050
Top leaves×Soil Ca/K.....	—.582**
Plant calcium:	
Bottom leaves×Soil calcium..	.455**
Top leaves×Soil calcium.....	.498**
Plant sodium:	
Bottom leaves×Soil sodium...	.439**
Bottom leaves×Soil Ca/K....	—.057

** Significant at .01 level.

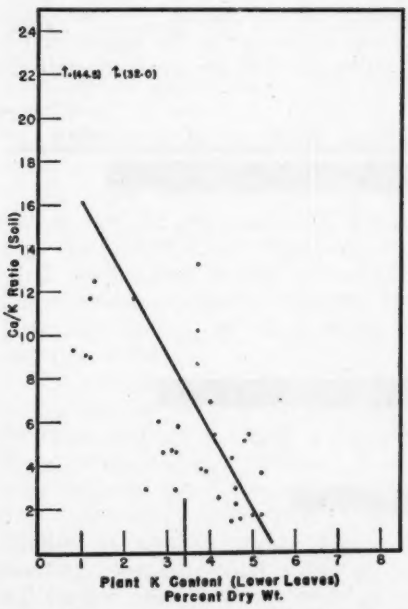

Fig. 3. Regression diagram showing the plant potassium content versus calcium-potassium soil ratio of 35 survey samples.

of these correlation coefficients are highly significant. The top leaves (—.582) were not as well correlated with the Ca/K ratio in the soil as were the bottom leaves (—.708), although still highly significant. In comparing the calcium content of the leaves with the calcium content in the soil, it was found that the correlation values were slightly greater in the top leaves (+.498) than in the bottom leaves (+.455). The sodium in the plant was also found to be correlated with the sodium in the soil (+.439).

These coefficients compare favorably with those obtained by Wallace (1952) for alfalfa in New Jersey (8) and Harding (1954) (3) on California citrus soils, with the exception of the latter's lack of correlation between calcium in the soil and calcium in the leaf. They can be used as a guide to the value of soil analysis. For example, the Ca/K ratio at which stocks may respond to fertilization can be estimated from the regression line (Fig. 3). Judging by the field samples that were observed to show deficiency symptoms on the leaves, a Ca/K ratio in the region of

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AGRICULTURE—
(from the Chemical Viewpoint)

By Erwin J. Benne

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THE objective of a chemical industry is to produce new substances in profitable amounts by reacting raw materials in the presence of suitable catalytic agents and under physical conditions favorable for good yields of the products. In many respects agriculture parallels such an industry. The photosynthetic process, catalyzed by chlorophyll, and a succession of subsequent chemical reactions, which are regulated by many catalysts and enzymes, convert simple raw materials into the complex variety of compounds composing agricultural crops. Husbandry practices seek to furnish the raw materials necessary for these reactions and to provide conditions sufficiently favorable for them to insure good crop yields.

The biochemical reactions which constitute the fundamental basis of agriculture produce every major class of organic compounds: acids, alcohols, aldehydes, esters, ethers, ketones, hydrocarbons, and countless interrelated combinations. Synthesis of these compounds occurs at ordinary temperatures using energy without cost from the sun; facts that would excite the envy of any chemical manufacturer.

At the beginning of the present century, authorities quite generally believed that the raw materials needed by plants for their chemical processes included only 10 elements: viz., calcium, carbon, hydrogen, iron, magnesium, nitrogen, oxygen, phosphorus, potassium, and sulphur, and that the other elements known to be present in plants had merely passed in as incidental contaminants and performed no physiological functions. However, subsequent investigations have proved both of these premises wrong, for it now appears that boron, copper, manganese, zinc, and probably molybdenum must be added to the essential list, and that under some conditions certain other elements, including aluminum, chlorine, iodine, silicon, and sodium can markedly influence the growth and health of some kinds of plants. Probably the earlier erroneous conclusions were drawn because observers failed to recognize seeds, impure chemicals, and containers in which plants were grown, as sources of elements needed by plants in only very small amounts.

Oxygen is the only element which higher plants use in elemental form, and as such it is mainly obtained from the air. Carbon is supplied as carbon dioxide from the air and from water solutions of simple carbon compounds that enter the plants through the roots. Water supplies the hydrogen, and under natural conditions all other elements used by plants must be obtained from water-soluble compounds in the soil. Recognition of this latter fact, together with the realization that these mineral elements could be supplied to plants by applying inorganic salts to the soils in which they were growing, came largely during the nineteenth century, although some key observations antedated that period. With this knowledge as a basis, such early leaders in this field as de Saussure, Boussingault, von Liebig, Lawes, Gilbert, Murray, Clemson, and others laid the

foundation during the 1800's for the multibillion-dollar commercial fertilizer industry in the world today.

Subsequently, much intensive investigation by workers in numerous fields of research has revealed that plant metabolism and growth require the performance of a diverse variety of functions by many elements reacting in a remarkable series of delicately balanced chemical processes, several of which may be proceeding at the same time within the same plant. Respiration, an oxidative, energy-releasing process, goes on continuously in all living cells of the plant, even while certain of these cells may be carrying on photosynthesis, a reductive, energy-fixing process. Translocation and storage of photosynthetic products, which processes necessarily accompany respiration and photosynthesis, involve the simplification of some compounds and the elaboration of others.

Thus some elements must serve to form the permanent structure of the plant; some must store energy and others must act as intermediaries in exchanging it; some must act as antidoting agents in counteracting adverse effects of excessive concentrations of others; some must serve as catalytic agents or as components or activators of enzyme systems; and still others must regulate translocation and storage of food reserves, reaction of plant sap, oxidation-reduction reactions, and osmotic phenomena.

Some elements must perform or participate in a number of these functions. Due to the complexity of the chemical processes involved in plant growth and metabolism it has been difficult to determine exactly what reactions each element takes part in and the specific role it plays; however, varying amounts of evidence, some of it conjectural, support the following information in this regard:

Aluminum acts as an antidoting agent against potassium by preventing it from collecting in injurious concentrations in cell surfaces. It also influences the permeability of protoplasm, the rate of photosynthesis, and the rate of diastatic action.

Boron is required for the proper functioning of calcium in metabolic activities, is necessary for plant growth processes, and prevents certain plant diseases such as girdle of beets and cracked stem of celery.

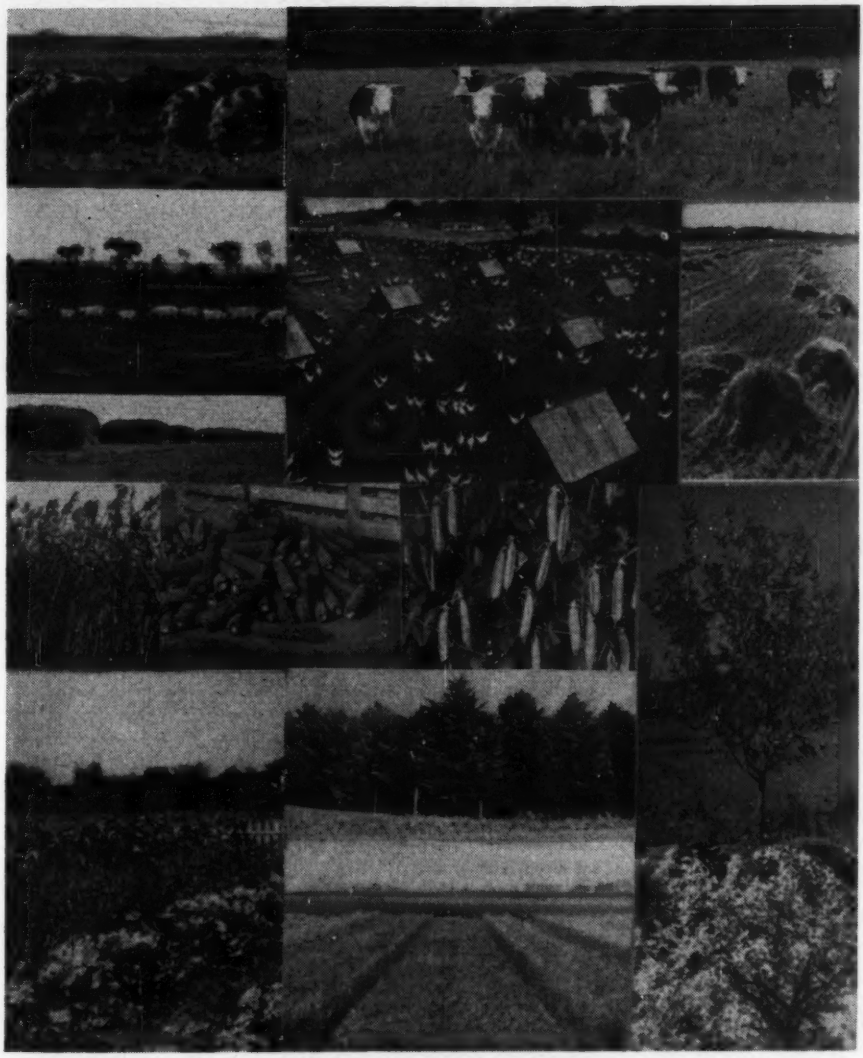
Calcium serves as a component of the structural parts of plants, acts as an antidoting agent against excessive quantities of magnesium, helps to regulate the reaction of plant sap by neutralizing organic acids, is necessary for the translocation of carbohydrates, and influences the physical condition of the protoplasm.

Carbon is the central element in all organic compounds in plants and as such constitutes a large proportion of the permanent structural materials composing them as well as being a constituent of all enzymes. It stores energy in photosynthesis and releases it in respiration, thereby playing a direct and important role in these vital reductive and oxidative processes.

Chlorine is believed to stimulate the activity of some enzymes, and to influence carbohydrate metabolism, the production of chlorophyll, and the water-holding capacity of plant tissues.

Copper acts as a catalyst or a component of enzyme systems, increases the production of dry matter by stimulating plant growth and development, and prevents certain types of chlorosis, rosetting, and dieback.

Hydrogen functions as an energy exchanger in photosynthesis and respiration, is a constituent of all plant acids and organic compounds, and as a component of water it functions as the medium in which all reactions within plants occur.



Chemical products of agriculture.

Iron plays an essential part as an oxygen carrier in biological oxidation, is necessary for the production of chlorophyll, and helps to prevent chlorosis.

Iodine influences growth as a component of the oxidation systems involved in metabolism.

Magnesium is a constituent of chlorophyll, hence, participates in photosynthesis as a component of this important catalyst, acts as a phosphorus carrier, and helps to prevent chlorosis.

Manganese influences the oxygen-carrying capacity of oxidase enzymes, participates in oxidation and reduction reactions, is required for carbohydrate metabolism, reproduction, and growth, and helps to prevent chlorosis.

Molybdenum is involved in that phase of nitrogen metabolism

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Fig. 1. A good crop of oats grown as a nurse crop on a well-fertilized Nova Scotian field.

Systematic Soil Testing Points the Way

By J. E. Milligan

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A MAJOR requirement for successful agriculture is that the farmer be able to obtain continued high yields of high quality crops at a low production cost, without impairing the soil. This, in turn, requires that the farmer be able to build his soil and maintain it at a high level of fertility. To do this requires information as to the potential fertility of the soil, the fertility requirements of the crops to be grown, and the soil treatments and management practices necessary to supply these requirements.

The busy farmer is not in a position to obtain this information for himself. He must depend on the numerous and varied technical services provided by government agencies. To assist in supplying necessary information to farmers, the Nova Scotia Department of Agriculture and Marketing provides a soil management service. This service includes analyzing soil samples, preparing reports giving interpretation of these analyses based on the specific conditions existing on the farms and fields from which the samples were taken, and giving soil management and treatment recommendations based on the most recent experimental results available that are applicable to the area in question.

For many years it has been the general consensus of opinion among agricultural workers that Nova Scotia soils were generally very sour, low in calcium, magnesium, and phosphoric acid,

Fig. 2. An unimproved pasture field in Nova Scotia.

but that they were reasonably well supplied with potash. Therefore, of first importance in a soil-building program was adequate use of agricultural liming material, followed by adequate use of high phosphate fertilizers along with careful conservation and use of barn manure and efficient utilization of legumes. With the exception of certain specialized crops such as apples and potatoes, the soil-improvement program in Nova Scotia has emphasized the points mentioned above. Also, the fertilizer recommendations made each year by the Maritime Fertilizer Council have been designed to meet these soil requirements.

That these recommendations were wise and well-founded is evidenced by the fact that more and more farmers

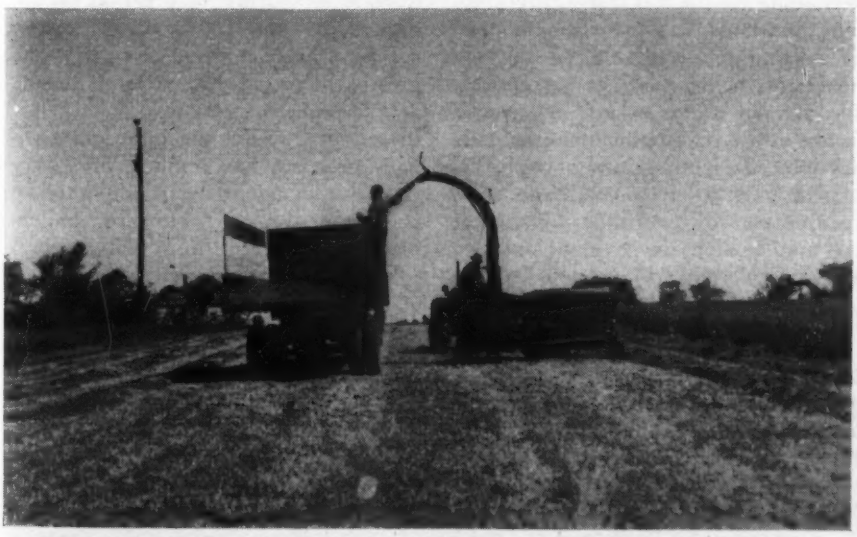

Fig. 3. Harvesting grass for silage in June at the Agricultural College, Truro, Nova Scotia.

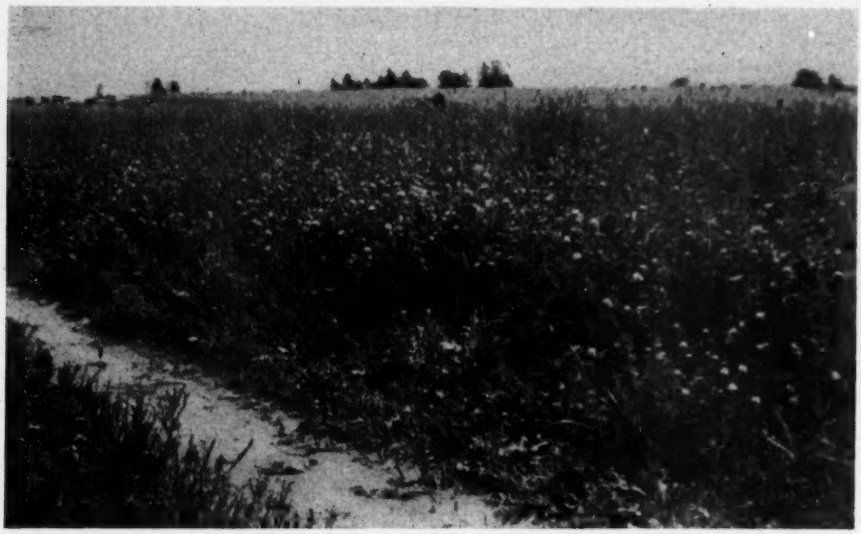

Fig. 4. The second crop following a heavy crop of grass and legumes harvested in mid-June for silage will be cut for hay.

are experiencing greatly increased yields of higher quality fruit, vegetable, and forage crops as a result of increased use of limestone, increased use of high phosphate fertilizers, more careful conservation and use of barn manure, and increased production of legumes.

Soil is not a stable material. It changes gradually from year to year depending on the soil treatments, cropping programs, and management practices being followed; and, if the soil treatments being used are not entirely adequate in every respect, deficiencies in one or more nutrients may gradually develop. It is the duty of technical agriculturists to study conditions from year to year to determine whether or not modifications in fertilizer practices are advisable and to take steps to have any necessary changes in practice brought into effect before a deficiency develops to the extent that it is seriously limiting crop production.

The results of analyses of soil samples taken in the Central Colchester area of Nova Scotia during the period of 1943 to 1951 show that there has been a very appreciable change in soil fertility levels during that period, as indicated in Table I.

From Table I it is seen that the greatly increased use of lime in the area has caused a very favorable change in soil pH. Also, the lime and fertilizer program has resulted in a very favorable change in available phosphate content of the soil. However, a definitely adverse trend in available potash is noted, which indicates that potash is

TABLE I.—SOIL FERTILITY LEVELS, 1943-1951

Year	No. of Samples	pH Less Than 5.8	P_2O_5 Low	K_2O Low
1943	1,785	82.13%	83.17%	66.00%
1945	1,177	89.27%	84.50%	76.40%
1946	1,098	85.60%	73.20%	.....
1951	2,195	49.90%	32.90%	84.30%

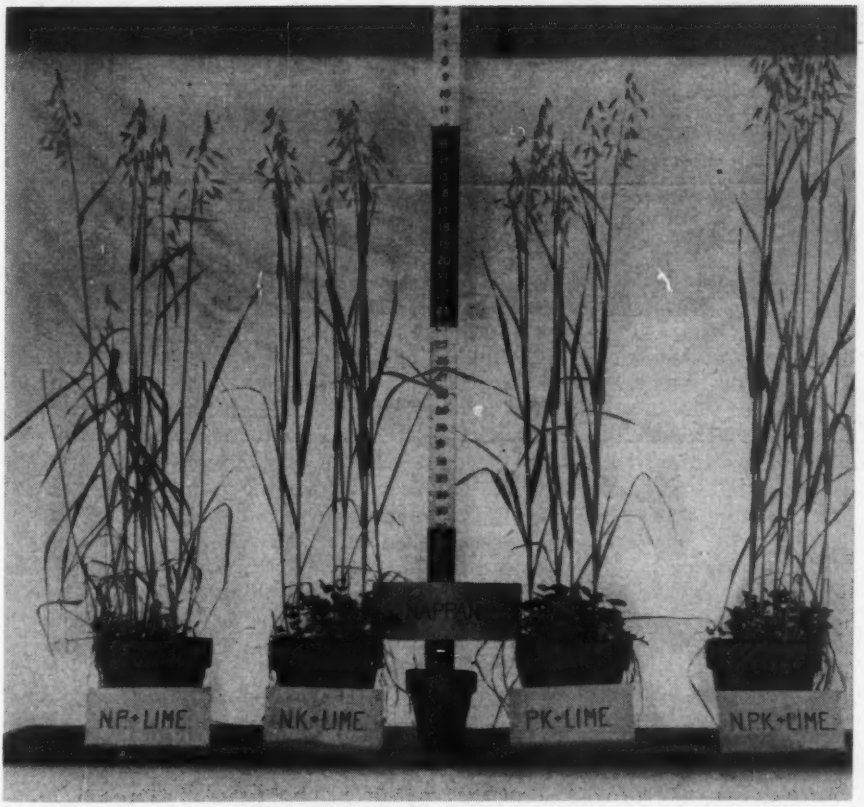

Fig. 5. Greenhouse pot experiment showing response from potash on both oats and red clover. Nappan clay loam soil.

not being supplied in adequate quantities to replace that removed by cropping and leaching.

The rate of decline in available potash in soil seems to be increased with more intensive use of agricultural lime, continued use of high phosphate fertilizer, and increased grass and legume production. This is clearly indicated by results of work carried out in the North Shore region of the Pictou-North Colchester district in 1943 and in 1950.

Fertility and Yield Improve

In 1943 a survey was carried out in this area during which 960 soil samples were taken for analysis. These were analyzed, and reports with treatment recommendations were returned to the farmer. This survey indicated that extreme soil acidity and low available phosphate were general throughout the district. Upon completion of this survey, a very vigorous program was started to encourage increased use of lime, with the result that sales increased very rapidly during 1944, 1945, and 1946 and have remained at a high level up to the present time. During the same period, crop yields were greatly improved. In 1950 a second survey was requested to determine the extent to which the lime and fertility requirements of the soil had been supplied during that period. This survey was carried out and included only those farms where increased quantities of lime had been used since 1943.

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Physical Condition of the Soil Affects Fertilizer Utilization

By R. B. Alderfer

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IN all of agriculture nothing is more universally recognized and accepted as being important to the growth of plants than the physical condition of the soil. Every farmer recognizes good and poor physical condition or tilth as a result of firsthand experience with excessive lumpiness and poor seedbeds, ease of slaking that produces thick impermeable surface crusts which impede seedling emergence as well as the absorption of irrigation and rainfall moisture, slow internal drainage, plow soles, and increased power required for tillage. These are some everyday evidences of poor physical condition. Like good health, good physical condition of the soil often is appreciated more after it is lost than before.

Physical condition is difficult to define because no single soil property can be used or measured to completely characterize or describe it. The reason for this is that it is manifest in so many different ways to such a great variety of people who use the soil. Soil physical condition embraces anything that has to do with the physical make-up and behavior of the soil, including such characteristics as texture, structure, moisture, aeration, temperature, consistency, along with its tillage properties.

Physical condition is of particular importance to the growth of plants because of the effect on the air, moisture, and temperature relations in the soil, together with mechanical impedance to root development and shoot emergence. Each of these plant growth factors is regulated by an extremely important physical property, which is the structure of the soil. Soil structure refers to the manner in which the stone, gravel, sand, silt, clay, and organic matter particles are arranged to form a particular pattern or system of pores whose number, size, shape, and continuity directly influence the permeability of the soil to air, water, heat, and plant roots. If any one physical characteristic were to be selected as indicative of the physical condition of the soil, permeability in all of its aspects would warrant very special consideration.

While the importance of good aeration, a plentiful supply of moisture available to plant roots, favorable temperature, an unrestricted rootbed, surface permeability and friability are unquestioned, the principal problem lies in trying to measure each of these conditions. We have been singularly unsuccessful in developing reliable methods of measuring the combined effect of all these conditions in the soil at any one time, to say nothing of the manner in which this effect may change throughout the year. This is the basic reason for our inability to find the answers to such pertinent and pressing questions as (1) How important is soil physical condition in crop production? (2) What are the soil physical condition requirements of our agricultural crops? (3) What effect does a given soil physical condition have on the uptake of the essential as well as the unessential elements by plants? Of particular significance is the influence of soil physical condition on fertilizer utilization.

In view of the great practical impor-

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Economical Use of Fertilizer in North Carolina

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NORTH CAROLINA has the natural advantage of a long growing season and generally well-distributed and adequate rainfall. Frequently, however, maximum production is limited by the low level of fertility. The basic fertility of the soil needs supplementing with lime and fertilizers for more economic production.

Factors such as are illustrated by the following pictures have been brought out often in Experiment Station information and Extension demonstrations, and the leading farmers have shown the possibilities of materially increasing general farm levels of production by taking advantage of this information. Yet, many problems still remain to be put across to the average farmer.

Figures 1 and 2 illustrate what is too frequently seen—eroding slopes, void of vegetation or covered with nonproductive growth.

Figure 3 illustrates the general low level of fertility and the residual effect of row fertilization of corn on a broadcast crop of crimson clover. Fertilizer had been put in the row for corn, and this was followed with crimson clover broadcast over the entire field. It will be noted that there is enough growth of crimson clover to be seen in the picture only where fertilizer was put in the row for corn. This bears out the general low fertility level in many of our Southern soils.

Figure 4 shows corn growth in the Coastal Plains area of North Carolina. This field is producing four times the State average. This is true where good stands of hybrid corn have been properly fertilized and adequately spaced. The same thing can be shown for other crops.

Figure 5 shows wheat producing twice the State average. Note the heavy stooling or suckering with 9 to 10 seed heads per plant. This is the result of early stimulation of growth and tillering by proper fertilization.

Figure 6 brings out one of the means of putting this issue before the farmer. The scene illustrates mass media education, where seeing is believing. The vegetation in the background gives mute evidence to the miracle which has been brought about to place hogs "knee-deep" in clover.

Figure 7 is a beautiful illustration of intensive livestock grazing to rolling land. This is a far cry from the story shown in Figs. 1 and 2. This is a simple story of lime, phosphate, potash, ladino clover, fescue, or orchard grass. The field is essentially no different in its possibilities from that shown in Figs. 1 and 2. Because of propert treatment, it is now contributing to a high level of living rather than permitting a waste of natural resources.

Figure 8 brings out another point in good fertilizer usage. The illustration shows corn and soybeans growing in a rotation, both fertilized in accordance with their need. In this instance, the soybeans were fertilized with high potash fertilizer, such as 0-10-20, and the corn with 5-10-10, 8-8-8, or 6-12-12,

depending upon the soil test. The corn was sidedressed with nitrogen because of the nitrogen requirement of the crop. The soybeans properly inoculated on a well-limed soil can fix the needed nitrogen from the air.

The type of information presented above has been recognized in the South by agricultural leaders. One of the big problems has been getting this information in the hands of and having it accepted by the man who will apply it in his everyday farming operations.

Fertilizer dealers frequently determine the grade of fertilizer purchased by farmers. The dealer is the last person to see the farmer before he buys his fertilizer, and the kind of fertilizer sold must be limited to the grades carried by the dealer. Therefore, any educational program resulting in the wide use of adapted fertilizers must be in cooperation with the local fertilizer dealer.

The Advisory Committee of the fertilizer industry cooperated in a program worked up in North Carolina this past year. The first step consisted of setting up meetings with county agents and with the supervisory personnel of the fertilizer industry in the winter of 1953-54. One meeting was held in each of the six Extension Districts in the State.

At these meetings a summary of the soil test information available for the type of farming area was distributed and discussed by representatives of the Soil Testing Laboratory. The fundamentals of fertilization were reviewed. An illustrated discussion relative to the economical use of lime and fertilizer emphasized three facts: (1) That the economical return for a dollar spent for a particular fertilizer constituent was dependent upon the level of that constituent in the soil; (2) that the response was dependent upon the specific requirement of the crop; (3) that the response was limited by any other fertilizer nutrients which might be in short supply.

County fertilizer meetings which would call together agricultural workers, fertilizer dealers, representatives of farm organizations, and a few leading farmers were proposed. At these meetings it was suggested that a set of slides dealing with the economical use of lime and fertilizer be presented as a preliminary part of the meeting. It was also proposed that a leading merchant or businessman, familiar with agriculture, point out the necessity of using our long growing season, our naturally abundant rainfall, and our soils to the best advantage through supplementing natural soil fertility by the proper use of lime and fertilizers.

A summary of the soil testing data, from the appropriate type of farming area, was made available to each group to show the general level of lime, phosphate, and potash in the samples which had been submitted to the Soil Testing Laboratory for the major crops in the area. In addition, summaries were presented to show the percentage of the samples submitted for a particular crop receiving different rates and grades of fertilizer.

With this information as a background, the county group was requested to take one crop at a time, become familiar with the general level of fertility of the soils sent in to the Soil Testing Laboratory for that crop, refer to the general fertilizer recommendations for the State to determine the specific requirements of the particular crop involved, and then on the basis of local demonstrations and experience, set up a fertilizer recommendation for that crop in line with the soil tests and the specific requirements of the crop. Where conditions varied from one section of the county to the other, these conditions and sections were named in setting up the fertilizer recommendations. Other crops grown in the area were discussed in the same manner.

The county meetings resulted in simplifying fertilizer recommendations. Twenty-three regular grade fertilizers

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Figs. 1 & 2

Figs. 3 & 4

Figs. 5 & 6

Figs. 7 & 8

The Editors Talk

Our Cover Picture

In the earlier accounts of the development of peach growing in this country there is the story of a tree in California which during the gold rush bore 450 peaches. These sold for $3.00 each—total return of $1,350.00 from the one tree. In 1855, six trees bore 1,100 peaches which sold for $1.00 each. Such prices, of course, are legendary, along with the many other fabulous tales incident to our Nation's growing pains. But they do testify to the popularity of this fruit, which today is second only to that of the apple.

The Spanish brought peaches to the New World, and as early as 1600 the fruit was common in Mexico. It is supposed to have originated in China. Reference to it was made in the writings of Confucius in the fifth century B. C.

In the United States, peaches today are produced chiefly in the Pacific Coast, Southeast, Northeast, and Midwest regions, with leading states being California, South Carolina, Georgia, North Carolina, and New York. California currently is supplying more than 50 per cent of the commercial peaches for fresh shipment and processing. In 1953, this State produced 772,000 tons with a farm value of $43,232,000.00. Two types comprise this production, the clingstone and the freestone peaches. Clingstones are utilized almost wholly for canning, while the freestones are utilized for fresh shipment, canning, freezing, and drying. The canned peach is a familiar and popular commodity, the Nation's pack having risen to over 20,000,000 cases annually in recent years.

For many years the only fertilizer deemed necessary for California peach orchards was nitrogen. This fertilizer is still a more or less standard application, but on some soil areas in the San Joaquin Valley a need for potash has been developing. Peach trees showing this potash deficiency do not size their fruit properly and their leaves exhibit consistent symptoms typical of this deficiency. In the Eastern part of the United States the need for potash is much more general. Of the deciduous tree fruits peaches undoubtedly have the highest potash requirement, and use of this plant food in the East has been greater than on the Pacific Coast.

Our cover picture was taken in the San Joaquin Valley. It shows peach leaves which are potash-deficient, compared to a normal leaf on the left. The affected leaves are yellowish green in color. Leaf edges are very noticeably curled upward along the entire length of the leaf. Scorched, brown areas develop along the leaf edges, and dead areas fall out, leaving ragged edges. Also shown are under-sized fruits from potash-deficient peach trees, while on the left are properly sized fruits from adjacent trees which received potash fertilizer applications.

The chemical analysis of peach leaf samples taken at the proper time of year is a method being successfully employed to indicate to peach growers the need for applying potash fertilizer. Less than 1.5% potassium in the leaves at midseason often may indicate this need, and serious effects result when leaf potassium falls below 1%.

As the Year Closes

As the year closes, we like to read the annual summaries and note the comparisons with the agricultural achievements of past years. In other words, with everyone else, we are interested in the status quo.

In looking at 1954, it is gratifying to find that despite all of the vagaries of the weather, the reactions to disturbing world and domestic political and economic influences, and other factors that affect our well-being, the year will be recorded as a good one for agriculture as a whole. Consumer income and domestic demand for farm products have continued strong and exports are running a little above a year earlier, according to the Agricultural Marketing Service of the U. S. Department of Agriculture. With carryover stocks large and total farm output almost as large as the record of 1953, grower prices are averaging about three per cent below a year earlier. This year's crops of wheat, corn, and cotton are smaller and prices received by farmers are higher than a year ago. However, increased production of hogs, chickens, and eggs have brought substantial reductions in prices of these commodities.

Total farm income for the year, of course, has not been determined as yet. As of the first of November, farmers received about 24.2 billion dollars from marketings in the first 10 months of this year, down four per cent from the corresponding period in 1953. Consumer income after taxes, which is conceded to be the best general indicator of domestic demand, has held at record levels this year, a little above 1953 despite the moderate cutback in output and employment since mid-1953. Expenditures for food have totaled slightly above a year earlier as consumers continued to spend about one fourth of their income for food.

With plenty for our old laws of supply and demand to work upon as the year closes, the look back can be one of satisfaction and gratitude for the forces in our American agriculture which keep it strong.

A New Book

"The Care and Feeding of Garden Plants" is the title of a new book just published by the American Society of Horticultural Science and the National Fertilizer Association. It tells how to identify and remedy plant hunger symptoms on lawns, trees, shrubs, fruits, vegetables, garden flowers, and house plants.

This book is aimed for the large number of people who have gardens and home plantings and want information on how to fertilize them. The problems faced by these people are fundamentally the same as those encountered by farmers, yet the applications to their own particular conditions are somewhat different. Specific information for this group has been scattered and sometimes virtually non-existent. In this book authorities on the various types of garden and home plantings have brought this information together and supplemented it with their own extensive knowledge and researches of themselves and associates. As a result, we have here a book rich in practical information for the suburbanite and helpful to others who have plantings of their own or who may be called upon for advice of this type.

Copies may be obtained from the National Fertilizer Association, 616 Investment Bldg., Washington 5, D. C., and the price is $3.00 per copy. Profusely illustrated with color plates, this will prove an excellent companion book to "Hunger Signs in Crops" which was published by the Association and the American Society of Agronomy and which has proved so popular and much in demand.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay [1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941.....	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942.....	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945.....	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946.....	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947.....	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948.....	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949.....	28.6	45.9	128.0	214.0	124.0	188.0	16.50	43.40	....
1950.....	40.1	51.7	91.7	173.0	153.0	200.0	16.70	86.50	....
1951.....	37.9	51.1	163.0	304.0	166.0	211.0	19.50	69.30	....
1952.....	36.9	50.0	196.0	331.0	157.0	209.0	21.05	70.00	....
1953									
December....	30.73	49.2	69.9	246.0	141.0	201.0	18.25	53.00	....
1954									
January.....	30.05	48.3	69.1	253.0	142.0	203.0	19.05	52.00	....
February.....	30.42	31.9	65.3	258.0	143.0	206.0	18.95	51.40	....
March.....	31.05	27.3	53.2	252.0	144.0	209.0	18.35	50.50	....
April.....	31.57	....	70.2	268.0	145.0	206.0	18.05	50.80	....
May.....	32.17	58.0	134.0	263.0	147.0	200.0	17.05	51.40	....
June.....	32.31	53.0	151.0	270.0	149.0	191.0	15.65	51.40	....
July.....	32.18	52.7	149.0	302.0	150.0	200.0	15.15	54.00	....
August.....	34.00	48.2	141.0	259.0	153.0	203.0	16.45	61.30	....
September...	34.55	53.0	116.0	236.0	153.0	207.0	17.25	61.60	....
October.....	34.67	53.6	93.2	212.0	145.0	208.0	17.55	60.20	....
November...	33.17	52.0	109.0	222.0	137.0	212.0	18.15	59.40	....
			Index Numbers (Aug. 1909—July 1914 = 100)						
1928.....	145	200	76	134	131	113	95	152	147
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	128
1931.....	46	82	66	83	50	44	73	40	107
1932.....	52	105	55	62	50	43	52	46	100
1933.....	82	130	118	79	81	84	68	57	90
1934.....	100	213	64	91	127	96	111	146	94
1935.....	90	184	85	80	102	94	63	135	116
1936.....	100	236	164	106	163	116	94	148	108
1937.....	68	204	76	89	81	109	74	87	114
1938.....	69	196	80	79	76	64	57	97	96
1939.....	73	154	100	84	88	78	67	94	98
1940.....	80	160	78	97	96	77	64	96	122
1941.....	137	264	116	105	117	107	82	211	138
1942.....	153	369	168	134	143	124	91	202	178
1943.....	160	405	188	235	174	154	125	231	270
1944.....	167	420	214	216	170	160	139	234	236
1945.....	181	366	205	232	198	170	127	227	240
1946.....	263	382	178	248	212	209	141	319	217
1947.....	257	380	232	248	336	259	148	381	262
1948.....	245	482	222	253	201	226	155	298	253
1949.....	231	459	184	244	193	213	139	192	232
1950.....	323	517	132	197	238	226	141	384	211
1951.....	306	512	233	346	259	239	164	307	269
1952.....	298	500	281	377	245	236	177	310	274
1953									
December....	248	492	100	280	220	227	154	235	224
1954									
January.....	242	483	99	288	221	230	160	231	271
February....	245	319	94	294	223	233	160	228	233
March.....	250	273	76	287	224	236	155	224	246
April.....	255	...	101	305	226	233	152	225	225
May.....	259	580	192	300	229	226	144	228	279
June.....	261	530	217	308	232	216	132	228	200
July.....	260	527	214	344	234	226	128	239	243
August.....	274	482	202	295	238	230	139	272	223
September...	279	530	166	269	238	234	145	273	170
October.....	280	536	134	241	226	235	148	267	191
November...	268	520	156	253	213	252	153	263	237

Wholesale Prices of Phosphates and Potash **

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports [2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports [2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports [2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports [2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
1950	.763	3.83	5.47	.371	.716	14.33	.195
1951	.813	3.98	5.47	.401	.780	15.25	.200
1952	.849	3.98	5.47	.401	.793	15.25	.200
1953							
December	.895	....	....	.430	.827	16.00	.210
1954							
January	.895	....	....	.430	.827	16.00	.210
February	.895	....	....	.430	.827	16.00	.210
March	.895	....	....	.430	.827	16.00	.210
April	.895	....	....	.430	.827	16.00	.210
May	.895	....	....	.430	.827	16.00	.210
June	.895	....	....	.359	.710	13.45	.174
July	.895	....	....	.388	.765	14.75	.184
August	.895	....	....	.388	.765	14.75	.184
September	.895	....	....	.388	.765	14.75	.184
October	.895	....	....	.388	.765	14.75	.184
November	.895	....	....	.388	.765	14.75	.184
Index Numbers (1910-14 = 100)							
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
1950	142	106	112	68	75	59	83
1951	152	110	112	72	82	63	83
1952	158	110	112	72	83	63	83
1953							
December	167	...	...	76	87	66	85
1954							
January	167	...	...	76	87	66	85
February	167	...	...	76	87	66	85
March	167	...	...	76	87	66	85
April	167	...	...	76	87	66	85
May	167	...	...	76	87	66	85
June	167	...	...	66	75	56	79
July	167	...	...	70	80	61	81
August	167	...	...	70	80	61	81
September	167	...	...	70	80	61	81
October	167	...	...	70	80	61	81
November	167	...	...	70	80	61	81

Wholesale Prices of Ammoniates **

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
1950	3.00	1.95	11.01	11.70	10.21	9.36
1951	3.16	1.97	13.20	10.92	10.18	10.09
1952	3.34	2.09	13.95	11.27	9.72	9.16
1953						
December	3.09	2.22	10.96	11.24	8.50	9.03
1954						
January	3.09	2.22	11.28	11.24	9.26	9.71
February	3.09	2.22	11.20	11.45	9.34	10.02
March	3.09	2.22	11.35	11.70	9.59	10.20
April	3.09	2.22	11.63	12.15	10.32	10.55
May	3.09	2.22	11.40	12.15	11.47	10.74
June	3.09	2.18	10.76	12.15	10.09	9.87
July	3.09	2.18	11.12	11.28	10.02	9.87
August	3.09	2.18	12.37	11.19	9.83	11.19
September	3.09	2.18	11.51	10.85	9.78	10.09
October	3.01	2.18	11.55	11.26	9.64	9.94
November	2.98	2.18	11.85	11.78	8.80	9.23
	Index Numbers (1910-14 = 100)					
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
1950	112	68	315	331	303	266
1951	118	69	377	310	302	287
1952	125	74	399	319	288	260
1953						
December	115	78	313	318	252	257
1954						
January	115	78	322	318	275	276
February	115	78	320	324	277	285
March	115	78	324	331	285	290
April	115	78	332	344	306	300
May	115	78	326	344	340	305
June	115	76	307	344	299	280
July	115	76	318	320	297	280
August	115	76	353	317	292	317
September	115	76	329	307	290	287
October	112	76	330	319	286	282
November	111	76	339	334	261	262

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and all Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1928.....	148	152	141	121	87	177	108	97
1929.....	148	150	139	114	79	146	114	97
1930.....	125	140	126	105	72	131	101	99
1931.....	87	119	107	83	62	83	90	99
1932.....	65	102	95	71	46	48	85	99
1933.....	70	104	96	70	45	71	81	95
1934.....	90	118	109	72	47	90	91	72
1935.....	109	123	117	70	45	97	92	63
1936.....	114	123	118	73	47	107	89	69
1937.....	122	130	126	81	50	129	95	75
1938.....	97	122	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	124	130	127	86	56	130	102	77
1942.....	159	149	144	93	57	161	112	77
1943.....	193	165	151	94	57	160	117	77
1944.....	197	174	152	96	57	174	120	76
1945.....	207	180	154	97	57	175	121	76
1946.....	236	197	177	107	62	240	125	75
1947.....	276	231	222	130	74	362	139	72
1948.....	287	250	241	134	89	314	143	70
1949.....	250	240	226	137	99	319	144	70
1950.....	258	246	232	132	89	314	142	72
1951.....	302	271	258	139	93	331	152	76
1952.....	288	273	251	144	98	333	158	76
1953								
December..	254	260	248	141	96	285	167	80
1954								
January...	259	263	250	142	96	300	167	80
February..	258	264	248	142	96	301	167	80
March....	256	264	250	143	96	307	167	80
April.....	257	265	250	145	96	323	167	80
May.....	258	267	250	147	96	338	167	80
June.....	248	265	248	141	95	311	167	69
July.....	247	263	248	142	95	310	167	74
August....	251	264	248	143	95	319	167	74
September.	246	263	248	142	95	308	167	74
October...	242	262	248	141	94	308	167	74
November.	244	262	248	140	93	301	167	74

* U. S. D. A. figures, revised January 1950. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] Potash salts quoted F.O.B. mines; manure salts since June 1941; other carriers since June 1947. Beginning June 1954, muriate of potash quoted on both mine and port basis.

** Where range of prices for fertilizer material is quoted, average figure is used. The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Fertilizer and Fertilizer Material, Fiscal Year 1952-53," State Dept. of Agr., Montgomery, Ala., Bul. 60.

"Fertilizers, Fertilizer Materials, and Rock Phosphate Sold in Illinois," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG 1635, Sept. 1954, S. W. Melsted and N. G. Pieper.

"Fertilizers—Their Purchase and Use on Field Crops," College of Agr., Univ. of Ky., Lexington, Ky., Misc. 10, P. E. Karraker.

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He: "What lovely legs you have!"

She: "I'm glad you like them. They were a birthday present."

Gal: "Gosh, can't you be good for five minutes?"

Gob: "Say, sister, I'll be good for twenty years yet."

Systematic Soil Testing Points the Way

(*From page* 23)

Table II is a summary of the results of soil analyses carried out in the course of these two surveys.

TABLE II.—SUMMARY OF SOIL ANALYSES, TWO SURVEYS—1943, 1950

	1943	1950
pH below 5.8	81.2%	38.5%
Available phosphate, low	73.0%	51.2%
Available potash, low	54.3%	92.7%
Number of samples	960	553

Dairy farming is the chief agricultural enterprise in the North Shore area of the Pictou-North Colchester district, with sale of butterfat and livestock providing most of the farm revenue. The chief agricultural crops are grain, grasses, and legumes. Prior to 1943 the main soil treatments included very limited use of agricultural liming materials, use of 2-12-6 as a grain fertilizer, and manure applied either under the grain or as topdressing on the hay and pasture land. Hay and pasture crop yields had declined to a very unsatisfactory level on a large percentage of the land in the area.

Records obtained during the course of these two surveys indicate that the only major change in soil treatments used after 1943 was increased use of agricultural lime and some increase in tonnage of commercial fertilizer.

From Table II it is observed that soil acidity has, in general, been greatly reduced and available phosphate has been increased in the soil, but the available potash has been greatly reduced. Thus, it is indicated that the great increase in lime use without any modification in commercial fertilizer treatments has increased the rate of decline of available potash in the soils of the area. Any soil management practice that is causing a progressive depletion of any plant nutrient must be viewed with alarm by farmers and technical

TABLE III.—ESTIMATED LOSS AND REPLACEMENT OF PLANT FOOD

	Nitrogen	Phosphate	Potash
Removed in harvested crops	7,372 tons	3,257 tons	11,830 tons
Leaching loss [1]	1,967 "	.....	17,433 "
Total	9,339 "	3,257 "	29,263 "
Supplied in com. fertilizer	1,564 tons	4,112 tons	1,509 tons
Supplied in manure	6,906 "	1,784 "	6,330 "
Supplied in legumes [3]	1,065 "	.....	.....
Total	9,535 "	5,896 "	7,839 "
Balance	+196 "	+2,639 "	−21,424 "
	(Deficit due to crop removal only—3,991 tons)[2]		

[1] Leaching losses expected from soil in rotation and having a good level of fertility. (2)
[2] Annual crop removal of potash from Nova Scotia soils exceeds that supplied annually in manures and fertilizer to the extent of 3,991 tons.
[3] Assuming 10% of grassland in legumes and 50 lbs. per acre per year of nitrogen fixed in the soil by legumes.

Fig. 6. Mangels growing on well-fertilized Nova Scotian soil.

agriculturists.

Now, at this point an obvious question is, to what extent is plant food being replaced in Nova Scotia soils in general?

This can only be estimated and an attempted estimate is presented in Table III.

Thus it appears that nitrogen is being supplied in adequate quantities to replace that removed by cropping and leaching. The same is true for phosphate provided the material is being applied to reasonably well-limed soils having a low phosphate fixation capacity.

Regarding potash, the situation is quite different. Assuming no loss by leaching, there is still a deficit of 3,991 tons per annum or approximately 16 lbs. per acre per annum. It is well-established that potash is lost in appreciable quantities by leaching. It is also known that Nova Scotia soils release considerable potash in an available form each year. Results of recent investigations would indicate that, on the average, potash released in an available form each year would about equal that lost by leaching. Thus this estimate indicates that the trends shown in Tables I and II are due to inadequate applications of available potash in our commercial fertilizers.

In view of the fact that most of the cultivated land in Nova Scotia is used for grain, hay, silage, and pasture, the discussion to follow will pertain specifically to these crops.

Results of experimental work indicate that potash deficiency has not developed, as yet, to the point where it is responsible for general crop failure. However, a limited supply of potash may be limiting the yields of grain, grass, and legume crops to a greater extent than suspected at the present time.

Replicated and randomized plot experiments carried out by the Nova Scotia Department of Agriculture and Marketing since 1945 indicate that to study crop response from applications of potash fertilizer requires much more refined experimental technique than is the case with applications of nitrogen, phosphate, lime, and manure. These experiments were carried out on different soil associations as mapped by the soil surveyors and have shown that:

1. Nitrogen applied with the grain

gives significantly increased grain yields but does not influence the hay crop the following year.

2. Phosphorus applications have significantly increased grain and hay yields on all soils.

3. Ground limestone applications have increased grain yields on some soils but have greatly increased hay yields on all soils.

4. Manure applications have significantly increased grain and hay yields on all soils.

5. While varying seasonal conditions influence the crop response from soil treatments, the relative response from nitrogen, phosphorus, lime, and manure applications has been quite uniform.

6. Experimental data obtained from these studies indicate that any project carried out to study the potash requirements of different crops on different soils involves a much more complex problem than is the case with other major soil treatments. For example:

(a) Response from potash is greater during seasons of low summer rainfall than during seasons of high rainfall.

(b) Potash applications increase grain yields on some soils with no increase in hay yields. On other soils no increase in grain is obtained but hay yields are increased, while on other soils, both grain and hay yields are increased.

(c) Potash applications on some soils have given significantly higher percentages of legumes in the hay crop without any significant increase in yield of total dry matter.

(d) It is indicated that the response from applied potash is increased as the pH of the soil is raised from the very acid to the slightly acid range.

(e) Rates of application of potash used in most of these fertility experiments have been similar to the rates used by the better farmers in the area. However, these rates have not, in any case to date, caused an increase in available potash in the soil as indicated by soil analysis.

Thus it would seem that one reason for the failure of many fertilizer experiments to prove conclusively the necessity of increased applications of potash on Nova Scotia soils may have been that these experimental designs have not been sufficiently long-term nor comprehensive enough to truly evaluate all aspects of potash utilization by agricultural crops.

In a grassland program such as that being developed in Nova Scotia, it is very desirable to be able to keep the land in good quality grasses and legumes for several years before reseeding becomes necessary. To do this is a problem on many farms.

Recent experimental work conducted at Cornell University (1) has been reported in part as follows: "Nutrient competition among species may also be of help in explaining the degeneration of pasture and meadow mixtures from desirable to undesirable species. It is observed that plant succession in productive meadow mixtures occurs as follows: desirable grasses and legumes > desirable grasses > undesirable grasses and weeds. This succession is commonly associated with depletion of fertility and with mismanagement. The rapidity of plant succession from desirable to undesirable species is probably enhanced by competition for nutrients among the species. Evidence of this is indicated by the relative intake of potassium by different species, i.e., high quality grasses > legumes > low quality grasses and weeds."

It is also pointed out that the vigor with which these species compete for potassium is variable, grasses being most vigorous in this respect.

Many farmers in Nova Scotia are, at the present time, experiencing difficulty in maintaining continued good yields of grass and legume crops without reseeding their land. This difficulty is evident on many farms where large quantities of lime and high phosphate fertilizers are used. Therefore, considering the progressive decline in available potash in Nova Scotia soils as indicated by soil analyses and the

influence of a limited available potash supply as indicated by the work carried out at Cornell, it is apparent that the time has arrived when commercial fertilizers with a higher potash content should be recommended for grain, grass, and legume crops in Nova Scotia.

This necessity for modification of plant nutrient ratios in commercial fertilizers has been experienced in various parts of North America as well as in sections of Europe.

On new agricultural soils, fertilizers having ratios of 1:6:1 and 1:8:1 have been used successfully, but as the agricultural age of the soils increased, the ratios have been changed to 1:2:1, 1:2:2, and 1:4:4. In sections of Europe where soils have been farmed for many years, the fertilizers are now based largely on the ratios of plant nutrients contained in the crop with allowance made for the nutrients that are applied in the form of barn manure.

The purpose of this paper is to present the changing trends in soil fertility that are apparent in Nova Scotia at this time, and to recommend that fertilizer usage be modified to supply developing soil deficiencies before they progress to the point of severely limiting general crop production.

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Economical Use of Fertilizer . . .

(*From page* 26)

are permitted to be sold in North Carolina, in addition to some of the higher analysis multiple ratio grades. In contrast to this, fertilizers required to meet the needs of the county were found to range from six to twelve grades, depending upon soil variation and the number of different crops grown in the county.

Grades appearing most frequently on these lists were 2-12-12, 5-10-10, 8-8-8, 4-8-10, 4-9-3, 3-9-9, 0-10-20, 5-10-5, 0-14-14, 3-9-6, 6-6-12, 0-9-27, 3-9-6, and 2-8-10. Of these grades, 2-12-12, 5-10-10, 8-8-8, and 4-8-10 were common to most counties.

There appeared to be mutual interest among the farmer, the industry, and the educational agencies in applying all available information for most economical production. This procedure overcame the frequent situation where recommended fertilizers were not available, or if available, were not generally recognized by the farmers.

Fifty-two of the one hundred counties held county meetings to discuss their basic fertility situation and their fertilizer needs for most economical production. The local fertilizer dealers, cooperating with the supervisory personnel of the fertilizer industry, generally made available the most adapted fertilizers for the local conditions.

Summary

North Carolina has a long growing season, a generally well-distributed and adequate rainfall, but the basic fertility of the soil needs supplementing with lime and fertilizer for most economical production. Experiment Station results, Extension demonstrations, and leading farmers have demonstrated the potential possibility of materially increasing general farm levels of production.

A coordinated educational program with the agricultural workers, the fertilizer dealers, the farm organizations, and a few leading farmers has resulted in studying the general soil fertility level as shown by a soil test, summarizing research and local information, and selecting a list of the most suitable fertilizers for the crops to be grown in the

county or section of the county.

The advantages of such a program can be listed as: (1) Coordinating the best information available in the county; (2) correlating fertilizer use with information available from soil test and the specific requirements of the crop; (3) coordination between recommendations by the agricultural groups and fertilizers made available by the fertilizer industry. Such a program seems to have so many advantages for everyone concerned that there appears to be no apparent reason why this type of program should not be continued and expanded in all of the counties in North Carolina.

Physical Condition of the Soil . . .

(*From page* 24)

TABLE I.—INFLUENCE OF SOIL STRUCTURE ON VEGETABLE CROP PRODUCTION HAGERSTOWN SILT LOAM, STATE COLLEGE, PENNSYLVANIA

Soil structure		Crop yield—tons per acre				
Aggregation %	Permeability in./hr.	Tomatoes	Peppers	Sweet corn	Lima beans	Carrots
13.5	1.57	17.5	4.0	3.8	1.7	23.3
28.9	5.42	26.4	5.7	6.1	3.1	37.0
Difference						
15.4	3.85	8.9	1.7	2.3	1.4	13.7
114%	240%	50%	43%	60%	82%	59%

All differences significant at 0.05 level.

tance of getting the most from the fertilizers we use, surprisingly little is known about the influence of a given physical condition on nutrient absorption. It has been shown by Lawton* that the uptake of potassium by corn can be reduced very sharply by poor soil aeration. As would be expected, plant growth was very greatly reduced. There is an urgent need for much more information on this important subject.

A series of experiments were established in Pennsylvania in 1952 and 1953 by the author to attempt to measure the effect which a range of structural conditions in the surface of plowed layer had on crop production. A similar study was initiated in New Jersey by Dr. S. J. Toth. The experimental sites chosen had been under continuous cultivation for years and had received large annual applications of commercial fertilizers. A synthetic soil conditioner, Krilium CRD-186, was used in both soils to stabilize different amounts of the fine soil particles into aggregates which produced a marked change in the structure of the plowed layer. A 5-10-10 fertilizer was applied at the rate of 1,200 pounds an acre and mixed with the surface layer.

The extent to which an improvement in the structure of the plowed layer of Hagerstown silt loam increased the yield of tomatoes, peppers, sweet corn, lima beans, and carrots is shown in Table I.

Yield differences ranging from 43% to 82% are large enough to merit serious

* Lawton, Kirk, Soil aeration affects fertilizer needs. Better Crops With Plant Food, October 1946.

consideration. The yields obtained from the soil in the poorer physical condition were such as to satisfy most vegetable producers, yet they were often less than one half of what is attainable with improvement in soil structure.

Increases in yield on even the sandy Sassafras soil were obtained from the improvement of its structure (Table II).

TABLE II.—INFLUENCE OF SOIL STRUCTURE ON VEGETABLE CROP PRODUCTION SASSAFRAS SANDY LOAM, NEW BRUNSWICK, NEW JERSEY

Soil structure	Crop yield—tons per acre			
Aggregation %	Tomatoes	Sweet corn	Carrots	Sweet potatoes
10.0	20.8	3.3	6.5	6.6
50.8	24.7	3.8	7.8	8.5
Difference				
40.8	3.9	0.5	1.3	1.9
408%	18.5%	15%	20%	28%

All differences significant at 0.05 level.

The influence which improved physical condition had on the utilization of the fertilizer applied has to be evaluated indirectly. Any increase in plant growth and yield which resulted from an improvement in the structure of the plowed layer would be represented by a proportional increase in the total quantity of nutrients required to produce a larger crop. The percentage of N, P_2O_5, and K_2O absorbed which came from the fertilizer applied to the crop was not measured, but it is reasonable to assume that this varied in proportion to the total increase in nutrient uptake.

Very large differences occurred in the number of pounds of N, P_2O_5, K_2O, CaO, and MgO contained in the roots, stems, leaves, and harvested portions of the two crops of tomatoes, sweet corn, and lima beans grown in the same soil, uniformly fertilized but with different physical condition (Table III).

Crop yields of the size attainable with improved physical condition will require the use of much larger amounts of fertilizer than are ordinarily applied today.

In the continuing search for ways of increasing the productivity of our land, improved physical condition could easily be the next important means of raising our production ceiling.

The most efficient utilization of the ever-larger amounts of fertilizer which the Agricultural Experiment Station workers are finding to be essential for maximum economic production will not be realized until the soil physical condition requirements of our crops have been met.

TABLE III.—INFLUENCE OF SOIL STRUCTURE ON THE UPTAKE OF PLANT NUTRIENTS HAGERSTOWN SILT LOAM, STATE COLLEGE, PENNSYLVANIA

Soil structure		Crop	Yield tons/A	lbs./A				
Aggregation %	Permeability in/hr.			N	P_2O_5	K_2O	CaO	MgO
13.5	1.57	Tomatoes	17.5	187	60	345	158	26
28.9	5.42		26.4	283	90	520	238	40
13.5	1.57	Sweet corn	3.8	78	30	23	7	7
28.9	5.42		6.1	122	49	37	11	10
13.5	1.57	Lima beans	1.7	162	41	192	104	13
28.9	5.42		3.1	295	74	350	189	24
				60	120	120		

Fertilization: 1,200 lbs./acre 5-10-10.

AGRICULTURE—
(From the Chemical Viewpoint)

(*From page* 19)

which concerns the reduction of nitrates during amino acid and protein synthesis.

Nitrogen is a vital component of protoplasm and functions as a storer of energy. It is a constituent of chlorophyll, amino acids, proteins, amides, alkaloids, enzymes, and structural materials of plants, and is essential for growth and reproduction.

Oxygen functions as an energy exchanger in photosynthesis and respiration, hence, is a dynamic component of protoplasm and a constituent of innumerable plant compounds, many of which form permanent structural materials of plants. As a component of water along with hydrogen it serves as the medium in which chemical reactions within plants are carried on.

Phosphorus plays an important role in plant metabolism as a constituent of many vital and structural compounds, as an accelerator of oxidative enzymes, and as a promoter of root development and a regulator of maturity. It functions as a storer of energy, is essential for respiration, and influences the reduction of nitrates and the synthesis of proteins.

Potassium functions as a catalyst and condensing agent, is essential for the formation of carbohydrates, oils, and proteins, stimulates diastase, invertase, and catalase activity, is required for normal cell division, reduction of nitrates, and chlorophyll formation, and serves as a translocation regulator.

Silicon influences the assimilation and utilization of phosphorus, serves as a component, affects the physical nature of structural materials, and is probably essential for photosynthesis.

Sodium acts as an antidoting agent against salts present in toxic concentrations, can probably serve some of the functions of potassium such as condensing agent, catalyst, and translocation regulator, and with some species of plants it appears to perform specific functions of its own.

Sulphur is a constituent of many plant compounds including proteins and structural materials, influences the formation of proteins and chlorophyll, increases root development, and stimulates the growth of legume bacteria.

Zinc appears to be involved in chlorophyll formation in that it can prevent chlorosis in some species of plants. It stimulates plant growth in some instances, and in others prevents physiologic disorders such as mottled leaf of citrus trees, bronzing of tung trees, and white bud in corn.

Although animal crops lack the ability to carry on photosynthesis, and therefore are dependent upon plants for their energy supply, the chemistry of their metabolism and growth is no less remarkable than that involved in these processes for plants. In the production of animal crops it is again a series of coordinated chemical processes that provide for the exchange of energy through respiration, for the digestion and distribution of food materials, for the development and functioning of circulatory, nervous, muscular, and skeletal systems, for sensory perceptions, and for locomotion. And surprisingly these marvelous processes involve only common elements, all of which are found in plants, although

not always in adequate supply for optimum animal nutrition.

Elements known to be essential for higher animals include calcium, carbon, chlorine, cobalt, copper, fluorine, hydrogen, iodine, iron, magnesium, manganese, nitrogen, oxygen, phosphorus, potassium, sodium, sulphur, and zinc. As do plants, animals use elemental oxygen from the air, but all of the other elements must be supplied by foods or mineral supplementation.

In animal as in plant metabolism the exact functions performed by each of the essential elements cannot always be stated with certainty, but the following information in this regard is believed to be true:

Calcium is a constituent of bones, teeth, and blood, is necessary for blood clotting, and helps to maintain proper degrees of nerve irritability and muscle contractility, and favorable acid-base relationships in the body.

Carbon is the central element in all of the organic compounds in animals, and as such is a constituent of all organs and enzyme systems. In respiration it releases energy and thus plays an important role in all vital metabolic processes.

Chlorine helps to maintain favorable osmotic relationships and proper acid-base balances, and as a constituent of hydrochloric acid is important in gastric digestion.

Cobalt is a constituent of vitamin B_{12} and is essential for hemoglobin formation.

Copper is required for the formation of hemoglobin, helps to prevent anemia, is an activator for certain enzymes, and is an antidoting agent against molybdenum in preventing teartness in cattle and against zinc and lead in preventing swayback disease in newborn and young lambs.

Fluorine is a constituent of bones and teeth, and is apparently necessary in trace amounts for the development of best quality teeth. More than traces of this element in animal diets may be injurious.

Hydrogen is a constituent of all acids, bases, and organic compounds in animals, hence, is important in maintaining proper acid-base relationships. It is a component of all enzymes, and as a component of water it serves as the medium in which all of the chemical reactions occur.

Iodine is a constituent of thyroxin, the hormone which regulates the rate of metabolism.

Iron is a constituent of hemoglobin, hence, is necessary for its formation. It is a constituent of the nuclei of body cells and of enzymes concerned with the oxidation of nutrients, and is required for the proper functioning of all body organs and tissues.

Magnesium is essential for bone formation, influences nerve irritability and muscle contractility, helps to maintain proper acid-base balances, and prevents the disease known as grass tetany or grass staggers.

Manganese appears to be an enzyme activator. Its lack may lessen growth and impair reproduction and lactation in mammals and in poultry cause perosis or "slipped tendon" and poor hatchability of eggs.

Nitrogen is a constituent of all amino acids, hence all proteins, is necessary for growth and maintenance of body tissues, is an energy exchanger in metabolism, and is a component of all muscular tissues.

Oxygen is required for respiration and functions as an energy exchanger in this process. It is a constituent of almost all body structures, and as a component of water it provides the medium in which all vital chemical reactions occur.

Phosphorus is a constituent of

bones, teeth, muscles, nerves, brain, and blood, hence, is required for the formation and maintenance of these structures, for the conversion of carbohydrates to fats, and for providing favorable acid-base balances within the body. Its lack results in depraved or loss of appetite, rickets, stiff joints, unthriftiness, and ultimately death.

Potassium is required to maintain proper nerve irritability, muscle contractility, osmotic relationships, and acid-base balances.

Sodium, like potassium, is necessary to insure proper nerve irritability, muscle contractility, osmotic relationships, and acid-base balances.

Sulphur is required for the oxidation of nutrients, is a constituent of proteins and of insulin which is required for the utilization of sugars.

Zinc appears to be a component of insulin and some enzymes, and is probably necessary for growth and normal hair development.

The necessity for specific molecular groupings, typified by enzymes, hormones, and growth regulators, along with the elemental requirements of plants and animals, emphasizes the delicate chemical balances that must be maintained in their metabolic processes. Efforts to determine the raw materials required for the formation of the complex compounds composing agricultural crops, the nature of the chemical reactions producing these compounds, conditions most conducive for their formation, and their importance in the metabolism of plants and animals, constitute the principal bases for technical research in agriculture.

Although these phenomena have been the object of much intensive investigation, many questions concerning them still remain unanswered, partly because of their complexity and partly because of inadequacies of existing analytical technics. Research on the metabolism, growth, and perpetuation of living matter, and on soil and plant relationships, or in a broader sense on the chemical phenomena upon which life depends, is constantly hampered by lack of analytical methods sufficiently sensitive and accurate to pierce farther into the mysteries of these processes.

It appears to be almost axiomatic that the quest for fundamental knowledge concerning these phenomena can advance only in proportion to improvement achieved in analytical technics and in their application to the analysis of the reactants and products of the chemical reactions involved. Until analytical procedures can be developed with sufficient refinement to permit investigators to test accurately for, and to control, the extremely small amounts of some elements which may conceivably affect the chemical processes carried on by living cells, but which thus far have escaped detection because of the crudity of available methods, it seems impossible to state definitely that any given element is not involved. Research programs in technical agriculture must include strong emphasis on, and adequate provision for, the perfection and refinement of analytical technics, if further insight into the chemistry of agriculture is to be gained.

Alfalfa in Mixtures . . .

(*From page* 10)

the last two years.

Now as a precaution, alfalfa does have disadvantages when compared with ladino clover. High yields and long-lived stands of alfalfa are more dependent upon good grazing or cut-

Fig. 5. Alfalfa responds to boron fertilization. Left: No borax application. Right: Borax was applied at the rate of 30 pounds per acre for establishment and at 15 pounds per acre for maintenance.

ting management than for ladino clover mixtures. Under Virginia conditions, alfalfa can not be cut more than three to five times per year. We have found it possible to maintain highly productive fields of alfalfa in the northern region of Virginia by cutting four times per year. In experiments and field practices we cut the first growth at a prebloom stage early in the season for silage and the next three aftermath growths have been used for hay or grazing, depending upon the feed requirements. Alfalfa has proved to be a good emergency crop for grazing during the dry season, but it should not be grazed unless it is allowed to grow up to a near or early blooming condition. When grazing it, it should be stocked heavily so that the animals graze it down within a week so as to permit it to recover. In brief, alfalfa stands can be maintained under grazing if a short grazing period (a week or less) is followed by a long recovery period (until the next blooming period).

The electric fence is a good tool to use when grazing alfalfa. Large fields of alfalfa should be cut into small strips with an electric fence so that available animals will graze a strip down quickly. The electric fences are moved as often as the alfalfa is grazed. Close grazing of one field for a short time does not injure alfalfa, but grazing a large field for a long time is a bad practice.

It should be emphasized that alfalfa has a higher lime requirement than other legumes and it is much more demanding of good soil physical conditions. Alfalfa will not survive on soils with a high water table or where surface water accumulates because of poor drainage. Our experiments also show that fertilization with borax is necessary for high yields and maintenance of alfalfa stands in mixtures as shown in Figure 5.

Children may tear up a house but they never break up a home.

Some men blaze a way; others only blaze away.

New Varieties Contribute to Wheat Production in North Carolina

(*From page* 12)

to Atlas was greater than one half the total.

In addition to total yield, Atlas wheats are higher in protein than older soft winter varieties and of good quality. For the first time wheats grown in this area have been found suitable for use in the production of bakers flour. One mill has used over 600,000 bushels annually for the past four years and has paid a premium for it. This premium has ranged from 10¢ to 35¢ per bushel. If an average of 20¢ is applied to the above 600,000 bushels, this is seen to have amounted to an additional $120,000.00. As this is a report from only one mill it seems conservative to say that Atlas can easily supply the demand for 1,000,000 bushels of wheat which previously had to be shipped in from the west.

With a reduction in acres it is important that recommended varieties be used to secure the best yields possible. If premium wheat can be produced, that will be an added advantage.

Potassium Affects Growth of Stocks

(*From page* 16)

9 or above might be expected to benefit from potassium fertilization. (Deficiency symptoms have been observed on leaves with potassium concentrations of 1.2-1.5% or lower.) If, however, the soil is quite low in potassium, providing an insufficient amount for proper growth, a condition can be present whereby deficiency symptoms may arise regardless of the calcium level in the soil. Also as the regression line and correlation coefficients imply, low soil potassium (not deficient in the first sense), accompanied by moderately high calcium or magnesium or total cations, can produce deficiency symptoms. Similarly a moderate potassium supply accompanied by excessively high calcium, magnesium, or total cations can produce such effects. Both a minimal Ca/K or Cation/K ratio and an adequate absolute supply of potassium are essential. This is indicated by the deviation of samples from the regression line when either potassium or calcium is extremely high or low.

Two groups of plants appear to deviate most from the regression line, (1) those that have low soil potassium but also low calcium, and (2) those that have moderately high soil potassium with low (to moderate) calcium.

The mean potassium content of the lower leaves representing 35 samplings was 3.43% (Fig. 3). Thirteen of the 35 samples were between 4% and 6% and one sample exceeded 6% potassium. Compiling all the data from both this survey and greenhouse experiments, a potassium content of about 3.5% in the plant would appear to be a desirable amount for promoting optimum growth and flower production. Also there appears to be no special growth period when this requirement would change to any great extent. However, it must be kept in mind that to maintain a constant level in the plant in the early growth periods, when plants are doubling their weight every few weeks, the

available potassium supply must be adequate to permit uptake to double simultaneously. It is at such times that potash fertilization may be most effective, providing other elements, especially nitrogen, are adequately supplied at the same time.

Summary

The potassium and nitrogen needs of stocks, an important floricultural field crop grown in southern California, appear to be comparatively high. Potassium deficient plantings have been observed with increasing frequency in recent years. This may be attributable to inadequate fertilization, continual intensive cropping, adverse plant competition, or unbalanced nutrient levels resulting from irrigation waters or fertilization practices.

An average potassium content in the lower leaf tissues of 35 plantings in 27 areas was 3.43%. Deficiency symptoms were observed on leaves with potassium contents as high as 1.5%. Four and 5% potassium in the tissues was common.

The extractable soil potassium measurement alone was not a good indicator of the availability of potassium to the plant. The calcium-potassium or cation ratio provided much better information.

A potassium content of about 3.5% in the dry leaf tissue is advocated as an optimum level for proper growth and flower production.

Grateful acknowledgment is made to Edwin Murphy and Rulin Ashcroft for valuable assistance in the field aspects of this project.

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Was Youth So Long Ago?

(*From page* 5)

kid was smart in school, alert and reliable in his relations with the fellows in their games. He had his mind set on being a professional man of some kind—maybe a lawyer or a doctor, or he would settle for vet practice or civil engineering. He often talked about his plans. What he wanted to do mainly, it seemed, was to be able to earn plenty so he might make life pleasanter and more comfortable for his father and mother in their old age, which was already in sight around the nearest corner.

But he was destined to be the family breadwinner for a long, long time—sooner and longer than he ever expected. Being the eldest, his folks wanted him to see to it that his sister

and two brothers were educated and college-trained. So Jim left school after high school graduation and began work as a shipping clerk, turning to other jobs that came to hand. Most of his wages and what his folks could spare went into the common family fund to give the others their start. Jim finally forgot his old dreams and hopes about a career, and plunged in with devoted diligence to the task his parents looked to him to do.

The girl finished college, found a good job as a secretary, and was married within three years. The two boys both studied medicine and after several preparatory years, they landed hospital appointments and went on to mature success and security. Not so Jim, for he married late and had no dependable job to see him through or any professional skill to depend upon. The only ray of comfort left to him and his wife as the years rolled on was the assurance that his two surgeon brothers would loan money on easy terms to any of Jim's kids who wanted to do better than their "old man." Jim's only "diploma" was a framed certificate on the sitting-room wall which his boss gave him for 25 years of "faithful service" in the wholesale grocery business, along with a dozen or so other fellows who stuck to the easiest and nearest road to a livelihood.

Strange and rather colorful persons also resided in that polyglot zone of his acquaintance. There was an old veteran who always wore his legitimate Grand Army button along with a whole hatful of emblems, insignia, badges, and medallions, all pinned to a purple cloth he donned apron-style over anything he might have on, winter or summer. His cracked and quavering voice could be heard reciting the valorous deeds and frightful carnage he had seen down in the bayous of the lower Mississippi against a fierce and unrelenting enemy. But some folks long before had taken the pains to look up his actual record in those fat books of soldiers' careers found in the files of the state adjutant-general. They found he had enlisted in the late winter of 1865 and had spent most of his time in the sick wards at Jefferson Barracks.

On a street corner leading into the business section of our town, there often stood a queer character who sold small stocks of notions from a box with a camp chair and a blackboard behind it. This chap posed as a memory expert. At this he became quite renowned locally. He'd offer to give the dates and results of every famous battle in almost any land, the birth years of famous people, and the locations of obscure places. He invited anybody to match historical knowledge with him. He sometimes varied his program by offering to write anyone's full name backwards as soon as spoken, and he did a few card tricks as extra attractions. At holiday time he recited long poems about Christmas, and served as a collection agency for the Salvation Army in the interval.

THEN one frequently met the fellow who went by the name of "der Mahler." He lived in a small boxlike house wedged in between two stores. Here he maintained what he was pleased to call his "studio." His paintings done on planed boards were merely daubs, not a doubt of it. Yet that was before they began to hunt out and sing the praises of the country's "natural primitives" in artistry. He may have been born too soon for that kind of recognition. At any rate, he sold raffle tickets for the ownership of his creations, which he either carried under his arm or kept stacked on the front porch of his shanty after the fashion of street exhibitors time out of mind. Our young observer never bought one of the Mahler's lottery tickets, although now and then someone did out of fun or charity. The fact remains, however, that diligent inquiry failed to find anybody who ever won a picture in that manner from him.

Another citizen was seen several times a week peering intently along

the outer edge of the sidewalk and into the gutters. He held a cloth sack which he filled with cigar butts and cigarette ends he gathered in the wake of smokers. The quirk in his case was that he never smoked himself, but he mixed and ground up the tobacco and tried to sell it to greenhouses, for insect repellents.

There likewise appeared uptown each day an old maiden lady who always clutched an enormous reticule bulging with packets and things. She toted her valuables and personal treasures with her because they were too precious to leave at home unguarded, she thought.

Many stores suffered minor losses at times from a light-fingered elderly lady, whose house was finally found to hold stacks and columns of odds and ends of merchandise, gathered for her own gloating amusement. Her strange museum collection was not discovered until her death, and the auctioneer who handled the public sale required four days to dispose of the accumulation. Much of the truck was so old and outmoded that none of the original owners uptown ever laid claims to any of it.

In his own section occurred one of the pleasantest of incidents. For several years an Italian from the settlement of new immigrants had been sweeping the street weekly to the lilting vocal music from famous operas. This street singer knew them all by heart, remembered from the old times in Milan, where he sat as a kid worshipfully perched in the cheaper seats far up and over the great shining stage. He had a clear, natural tenor voice and sometimes on a Saturday evening when the households were taking an airing on the porches, he and his brother marched along playing accordions and singing these sprightly airs.

Among those who loved to hear this entrancing music done so naturally and well was a girl in her teens. She lived in a squatty brick house on the corner which the Italian minstrels passed and repassed so often. She already possessed a beautiful childish soprano, the delight of church and Sunday school, where she sang without thought of the future. Every time the Italian street cleaner and his brother paused in their vivid minstrelsy, little Anna peeked from the sitting room through long lace curtains. It was not long before she got well acquainted with these talented fellows. They heard her sing in church and applauded. They told her to proceed steadily with her voice and her musical inclinations.

TO make a long story readable, this she did, at their behest and with her parental encouragement. All the long hours of practice and repetition never phased her. Later she went to a nearby large city and completed her education in voice culture. In five years she was singing in the chorus of grand opera, and in ten years this timid young girl emerged as one of the "finds" that make the music world a mecca for people of talent and ambition and hard drudgery. But she came back one Christmas week and took the leading role in a musical extravaganza of folklore and holiday glee. Singing with her were the two Italian brothers. The arias she sang so wonderfully were dedicated in her mind to the inspiration she received from the sweeper of the streets.

These, therefore, were the memories that clung the best to the young fellow of our story. To mingle the best of memories of past times with the gladness of the present and the hope of the future is something that lends to our lives the inspiration and the urge to do as well as we can, whatever may temporarily disturb us. Then youth and dreams and ambitions do not seem so long ago. They make us kindred and boon companions with those who retain their physical youth, and prove once more to us that vitality and spiritual values based on decency and rectitude are ours to realize always—no matter if youth itself has vanished, and with it many of our dearest friends. Merry Christmas to you all!

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Father: "Do you think you could support my daughter if you married her?"

Suitor: "Yes, sir."

Father: "Have you ever seen her eat?"

Suitor: "Certainly, sir."

Father: "Have you ever seen her eat when no one was watching?"

* * *

Two fellows stopped on the street to pass the time of day. "How's things at home?" inquired one.

"Well," replied the other, "the old woman ain't talking to me, and I ain't in no mood to interrupt her."

* * *

A man named Smith met a gentleman named Sexauer at a party. They hit it off rather well and as they had some mutual business interests they parted agreeing to have lunch the following week. Smith couldn't make it, and wishing to call his new friend he remembered that he worked at one of the investment houses but couldn't remember which one, so telephoning one of the larger companies he asked the switchboard girl:

"Do you have a Sexauer there?"

"No," was her prompt reply. "We don't even get a coffee break around here."

* * *

Joe—"When a man is faced with two evils, what is usually the best choice?"

Tim—"It's hard to say; but I've noticed most of 'em pick the blonde."

Six-year-old Peter was playing in the garden with a little girl friend when he suddenly hit her and she ran home sobbing.

His mother came rushing outside. "Peter," she said, "you had no right to hit Jean. What did she do, anyway?"

"We were playing Adam and Eve," Peter replied, "and she ate the apple instead of tempting me."

* * *

Two city boys visited a farm and returned filled with wonder at the things they had seen. David, age 7, was overheard explaining milking machines to Dick, age 6. He said: "They just put those things under the cow and wait until she starts to breathe."

* * *

It seems that a touring Californian stopped at one of the many Florida roadside markets and upon seeing a watermelon, he asked, "What's the price of this cantaloupe?"

The clerk looked at the man and then at his car tag and replied, "Take your finger off that olive."

* * *

"I hear dat banker's kinda tight."

"Tight? Nawsir! Why dat man as generous as I ever seed. He loan me 5 dollahs 2 yeahs ago and he never asked fo' it yet. I go 'round every Sat'd'y an' pay him two bits intrus, an' he says fo' me not to worry 'bout de principal. No, suh, dat banker's bighearted."

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